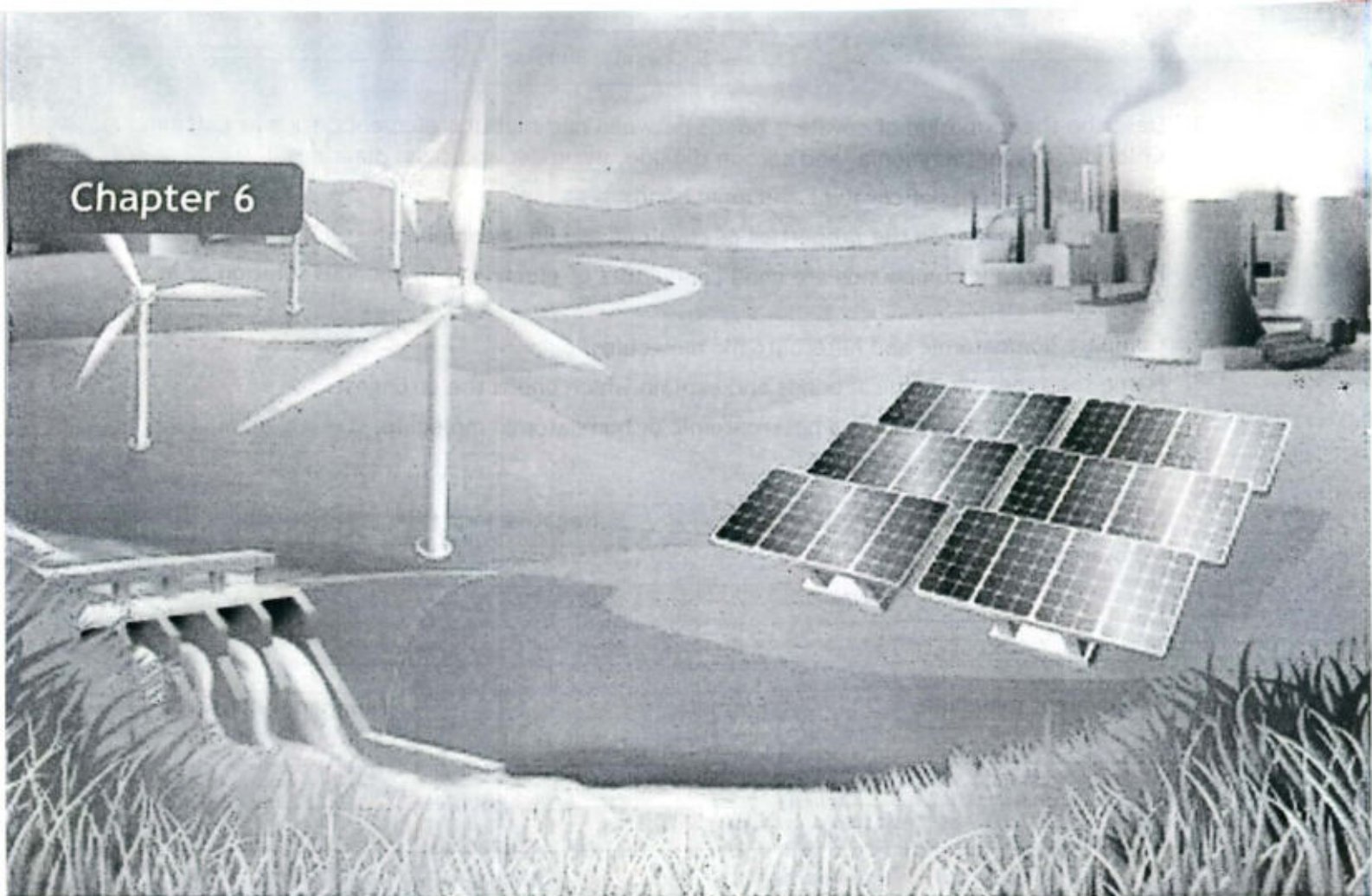


Chapter 6



ENERGY RESOURCES

SLOs: After completing this lesson, the student will be able to:

1. Differentiate between renewable and non-renewable energy resources.
2. Justify renewable energy resources are more beneficial than non-renewable energy resources.
3. Describe the phenomenon of greenhouse effect and its impact on climate.
4. Discuss the hazardous effects of smog and the environment and human health.
5. Recognize the significance of greening education and how it helps in sustainable development.
6. Identify the greening skills and describe how these skills help you to prepare for their future.
7. Compare green skills with 21st century skills as a pathway to the future.
8. Explain changes in atmospheric pressure with altitude [prior knowledge of pressure can be added.]
9. Create solar oven and identify the scientific concept involved in it. [STEAM]

Carbon cycle: The carbon cycle describes the process in which carbon atom continually travel from the atmosphere to earth and then back into atmosphere.

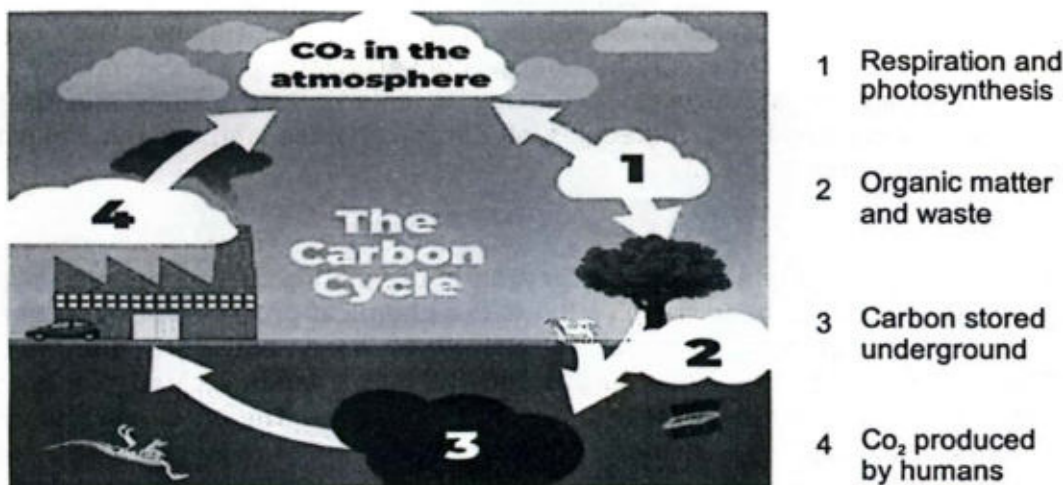


Fig. 6.1: Carbon Cycle

Carbon forms the essential chemical structure for all living beings on Earth. It is the basis of all life; we are made of carbon, consume carbon, and human activities burn fossil fuels for industry and daily life, releasing CO₂ back into the atmosphere. Carbon dioxide is also released into the atmosphere through human and animal respiration.

Some of the carbon in the atmosphere may be captured by plants during photosynthesis to produce food. This carbon is then consumed and stored in animals when they eat plants. When animals die, they decompose, and their remains become trapped in sediment at the bottom of bodies of water or on the Earth's surface. Over time, this stored carbon may form layers that eventually turn into rocks or minerals. Some of this sediment may even form fossil fuels such as coal, natural gas, or oil, which release carbon back into the atmosphere when burned, thus continuing the cycle. Carbon cycle consist of mainly two processes.

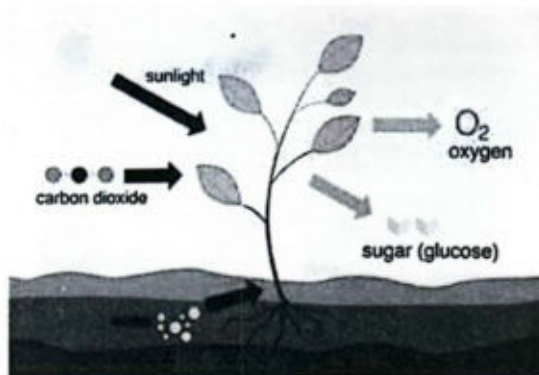
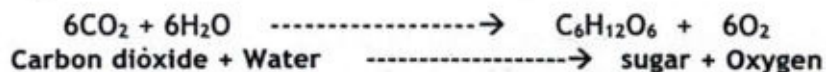


Fig. 6.2: Photosynthesis

1. Photosynthesis

Photosynthesis takes place in green plants that contain chlorophyll. In this process, they make use of sunlight and water.



Some of the carbon in the atmosphere may be captured by plants during photosynthesis to produce food. This carbon is then consumed and stored in animals when they eat plants. When animals die, they decompose, and their remains become trapped in

sediment at the bottom of bodies of water or on the Earth's surface. Over time, this stored carbon may form layers that eventually turn into rocks or minerals. Some of this sediment may even form fossil fuels such as coal, natural gas, or oil, which release carbon back into the atmosphere when burned, thus continuing the cycle. Photosynthesis is the process where light energy converts into chemical energy and stores in sugar. Further, it is a process occurring in chloroplasts making the use of chlorophyll. This process needs six molecules of carbon dioxide and six molecules of water along with energy from light.

2. Respiration

Breathing is the physical process of inhaling oxygen and exhaling carbon dioxide in and out of our lungs. On the other hand, respiration is the chemical process where oxygen is utilized to break down glucose to generate energy to carry out different cellular processes. The respiratory system helps in breathing. The air inhaled through the nose moves through the pharynx, larynx, trachea, and into the lungs. The air is exhaled back through the same pathway. The human respiratory system is a system of organs responsible for inhaling oxygen and exhaling carbon dioxide. The important respiratory organs in living beings include lungs, gills, trachea, and skin. Respiration occurs in all living organisms. Thus, it is a process that converts oxygen and glucose into carbon dioxide and water and ultimately makes energy for your body cells.



These are two reciprocal processes that aim to obtain energy but through different methods and sources.

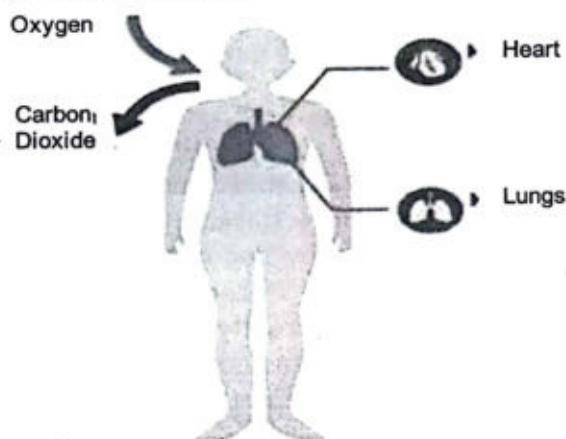


Fig. 6.3: (a) Respiration in Human

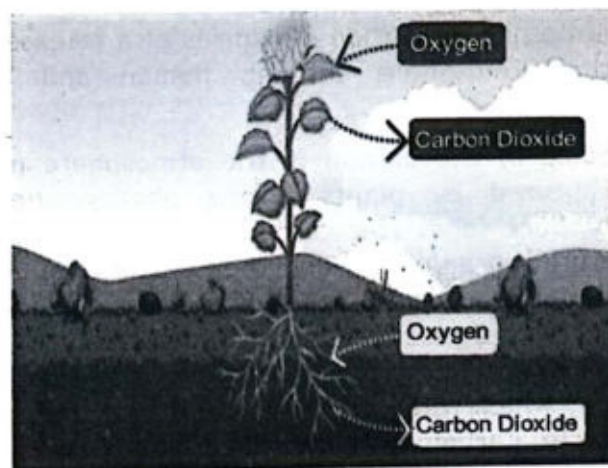


Fig. 6.3: (b) Respiration in Plants

6.1 ENERGY RESOURCES

A source from which energy can be obtained to provide heat, light, or power is known as energy source. There are two types of energy sources.

1. Renewable energy source
2. Non-renewable energy source.

Renewable energy sources

are produced from natural sources that can be made again over the time. Renewable energy sources are such as solar and wind energies. Some of the main sources are solar, wind, biomass and hydroelectric. Renewable energy is produced from natural sources that can be made after some time these sources such as solar and wind are refreshed naturally. One of the key advantages of renewable energy is that they do not emit greenhouse gases, which are the primary cause of climate change. Sources of renewable energy are positively impacting the environment as it is helping to slow down (or reduce the amount of CO₂) the disruption to plant and animal life, rising sea levels, extreme weather conditions, and other associated effects of climate change.

A. Hydro-electric Energy

As we know that the mechanical energy has two types. One is the potential energy (P.E) which is the ability of a body to do work due to change in its position (in case of gravitational potential energy with altitude P.E increases). Second is the kinetic energy (K.E) which is the ability of a body to do work due to its motion. Hydro-electric energy generation is the process of using gravitational P.E of water to generate electricity.

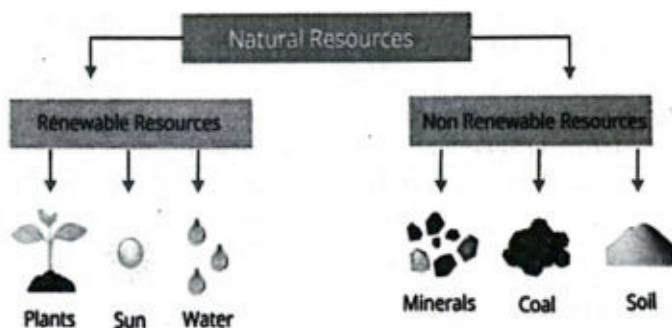


Fig. 6.4: Energy Resources

Interesting fact

Everything around us is Energy. It can come in different forms - mechanical, thermal, radiant, electrical, chemical, or nuclear. Renewable energy is a form of clean energy that is provided by natural sources in nature.

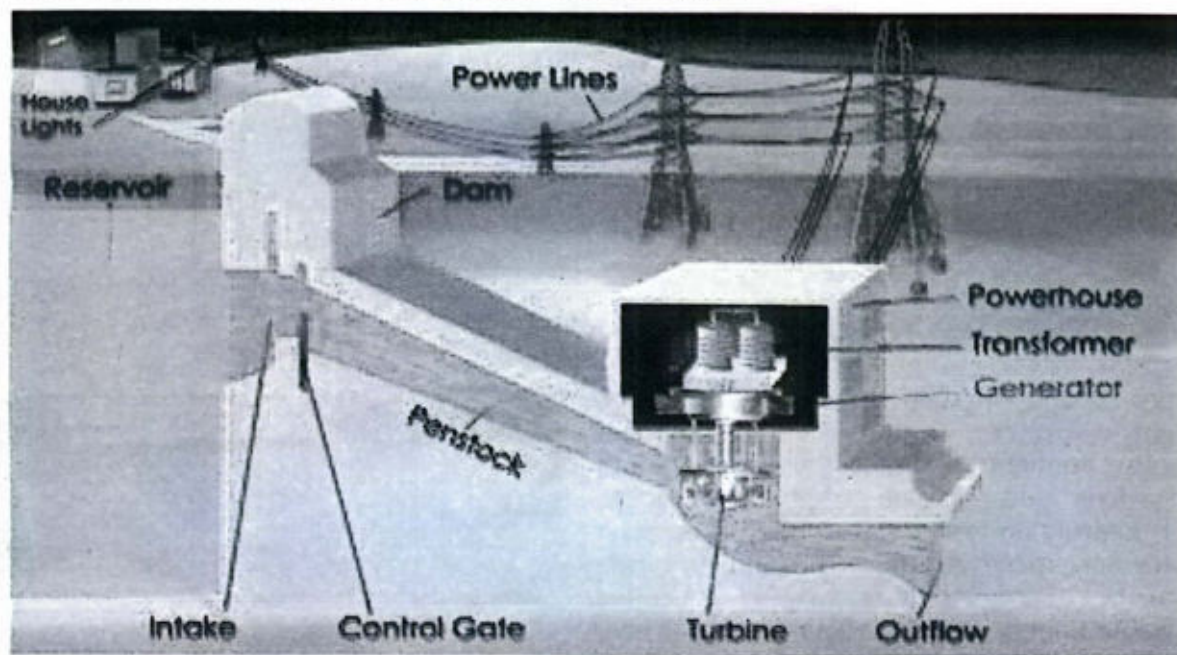


Fig. 6.5: Hydro-electric power plant

In this process the water flowing downstream is stopped in a dam and then allowing it to flow through the tunnels in downstream from a height. At height it has the gravitational P.E which is converted into K.E when water flows down. At the bottom the K.E of water is utilized to rotate the blades of turbines which due to magnetic field produce electricity due to rotation. The water then flows through rivers reaches to the oceans and seas, from where again it rises to skies due to evaporation and due to condensation it forms clouds. The rain from these clouds on high lands again brings the water into the reservoir of the dam. This natural process continues and becomes a non-terminating source of pollution free and safe energy. A hydro-electric power generation process is shown in figure 6.5.

B. Solar Energy

The energy from the Sun is constantly reaching the surface of the Earth in form of light and heat radiation. This energy can be utilized for useful purposes like generation of electricity and heating. On average the energy reaching from the sun in the form of light is 1 kW on a square meter area of the surface of Earth.

Solar energy can be utilized in mainly two ways. One is the conversion of sunlight directly into the electric energy using a photovoltaic cell which is also known as solar cell. A solar cell is made up of silicon a semiconductor material, which generate electric current when exposed to light. By connecting solar cells in series solar panels are formed. The schematic diagram of a solar panel and solar cell are shown in figures 6.6 and 6.7 respectively.

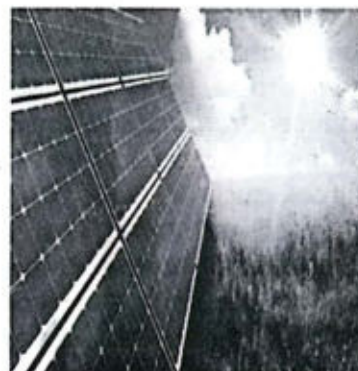


Fig. 6.6: Solar panel

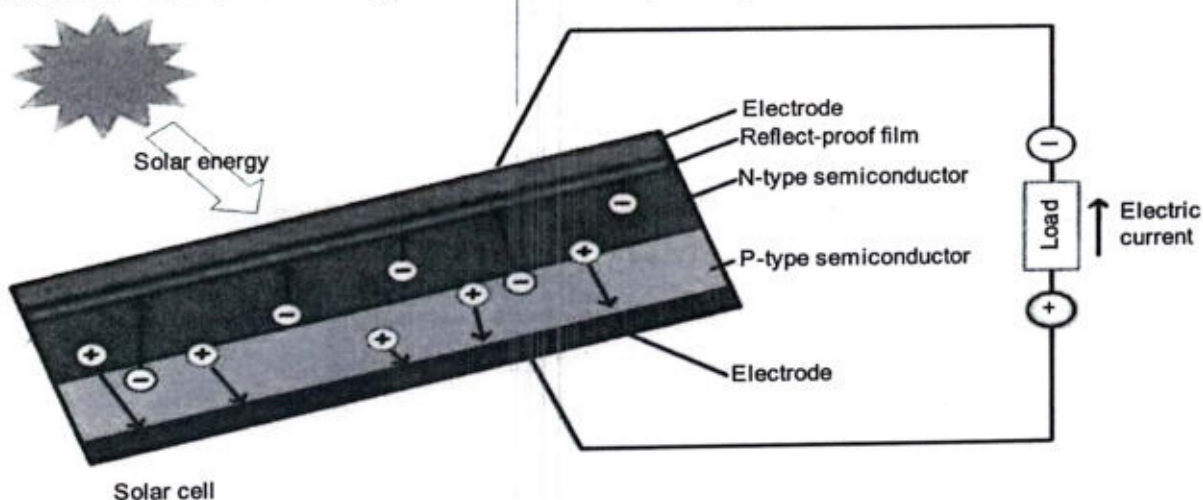


Fig. 6.7: Solar cell

In the second method the heat from the sunlight is utilized. In this method the heat from the sunlight is directly used in various applications such as electricity generation, water heating in solar water heater or solar geysers and space heating. The Sun is a free source of energy that is why it is called renewable energy resource. Solar energy is eco-friendly and has no harmful effects on environment as they do not emit any gas or



Fig. 6.8: Solar water heater

pollutant hence this is called safe and clean energy, however a large land area is required to produce significant amount of electricity. The solar water heater in which sunlight is used to directly heat the water is shown in figure 6.8.

C. Wind Energy

The kinetic energy (K.E) of the wind can be used to run the turbines which in turns produce electric energy. They have large rotor blades connected to a hub, gearbox and generator. The blades convert wind's kinetic energy into rotational energy, which rotates the coil placed in magnetic field in the generator which converts the rotational energy into electric energy. The length and size of rotor blades are important for the turbine's efficiency. A wind form and schematic diagram of wind mill are shown in figures 6.9 and 6.10 respectively. Wind turbines are often grouped together in wind farms to maximize energy production. These farms are best to build on coastal areas, plains and mountain passes, where wind blows more. Wind energy is eco-friendly and renewable energy source. It has zero pollution or greenhouse gases production. However they are only viable in areas with constant and strong winds. Wind farms require a significant amount of open space.



Fig. 6.9: Wind mills

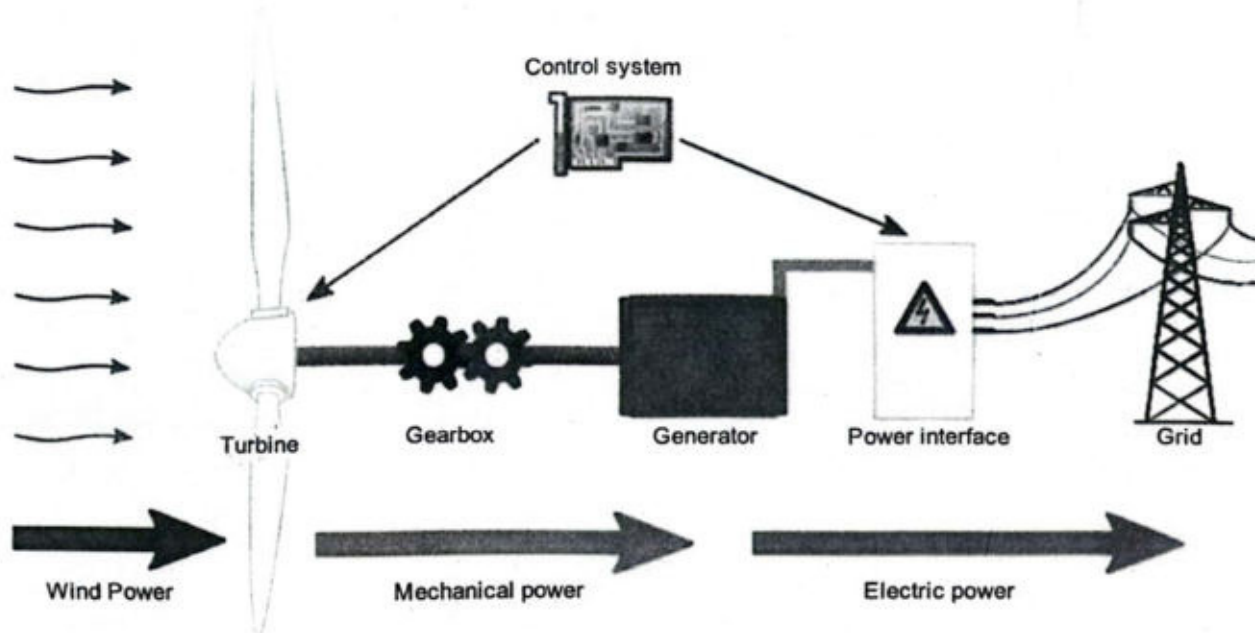


Fig. 6.10: Wind energy

D. Energy from Sea and Ocean

As we know waves are generated every time on the surface of large water bodies like lakes, seas and oceans. Waves are produced on the surface of water mainly due to wind. But sometimes we see large tides in seas they are mainly produce due to the gravitational pull of moon. Energy can be generated from both waves and tides by different techniques.

From the waves on the surface of water the kinetic energy (K.E) of waves is converted into electric energy by the means of devices known as the wave energy converters. There are many

types of wave energy converters each with its own design and working principle. One type is Salter's duck which have two parts one is stationary and the other moves with waves, this relative motion is then converted into electric energy.

Other is the point absorber which moves up and down with waves, this vertical motion powers a system that converts the mechanical energy into electricity like a hydraulic pump. The Salter's duck and point absorber are shown in figures 6.11 and 6.12 respectively.

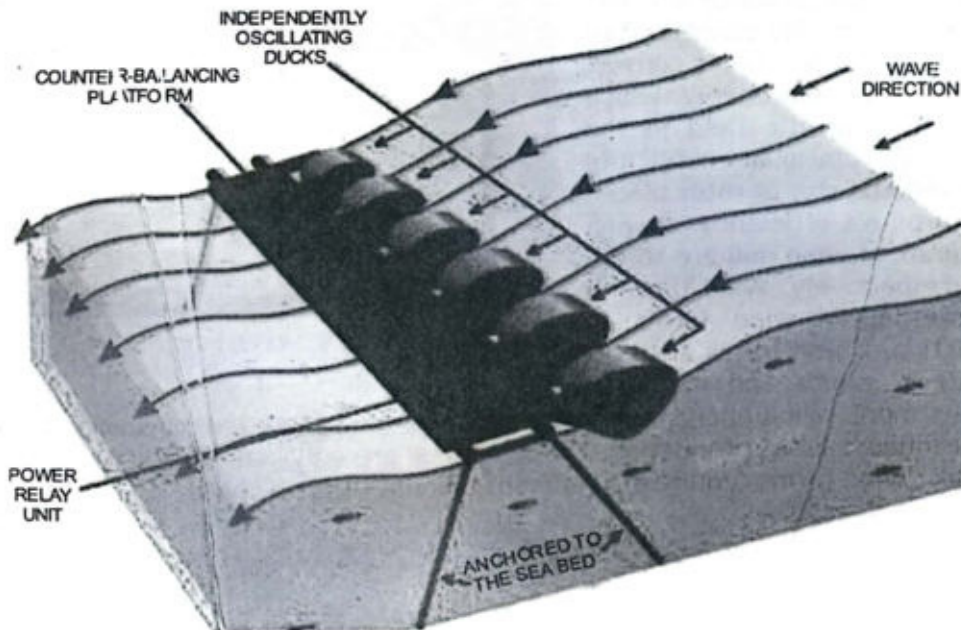


Fig. 6.11: Salter's ducks

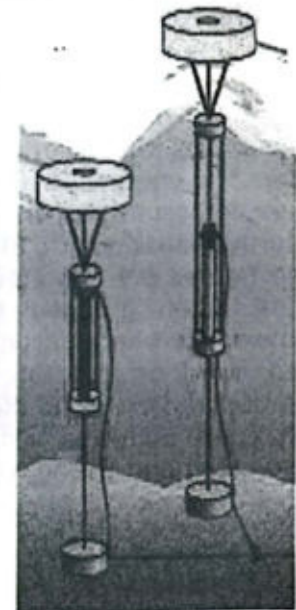


Fig. 6.12: Point absorbers

The other method for obtaining electricity from the sea is from tides.

As we know that on average one to two tides are produced daily in the seas, which bring a huge amount of water on shore. If we construct a 'Tidal barrage' (which is like a dam built on rivers) on the shore to store water at high tide passing through barrage, after the high tide passes the water flows back into the sea but barrage stores the water which is at higher level than the sea level.

By passing the water from the tunnel (outgoing tide) the turbine can be run which converts kinetic energy of water into rotational energy and this rotational energy in the generator produces electricity. A tidal barrage and its working are shown in figures 6.13 and 6.14 respectively.

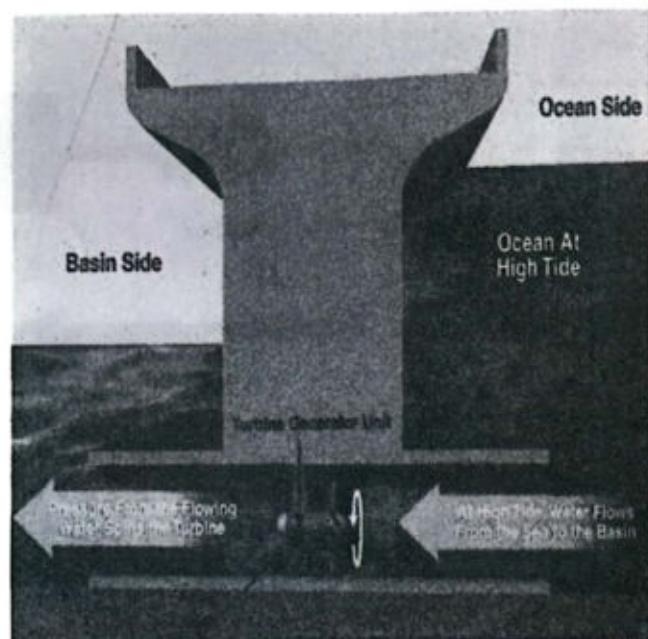


Fig. 6.13: Tidal barrages

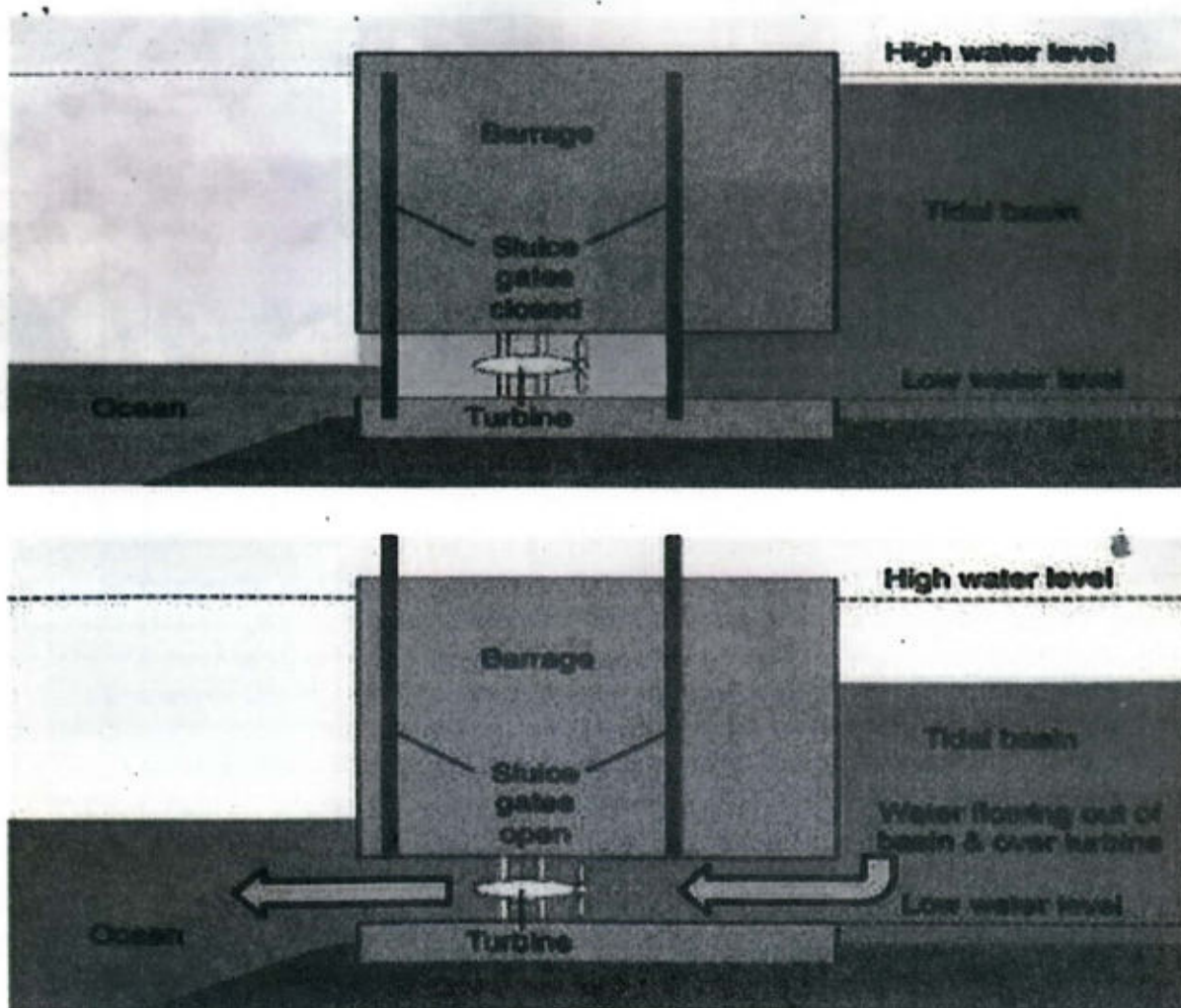


Fig. 6.14: Tidal barrage Working

Non-renewable energy

Non-renewable energy comes from finite resources that will eventually be diminished. They are considered less sustainable and damaging to the planet, with non-renewable energy being responsible for producing pollutants such as **greenhouse gases**. There are different types of non-renewable energy sources. These include the following: Coal, Oil, Natural Gas and Nuclear Energy

A. Coal

Coal, the most abundant fossil fuel globally are remnant of debris of plants. The combustion of coal produces highest levels of pollution. Coal has been using by human for thousands of years, but in recent 50 years we use as much coal as in the previous entire history. This leads to fast decrease in reserve underground. From underground reserves coal is usually mined. Coal is used as fuel in industries and domestic uses. A picture of coal power plant and burning of coal in local household are shown in figure 6.15.

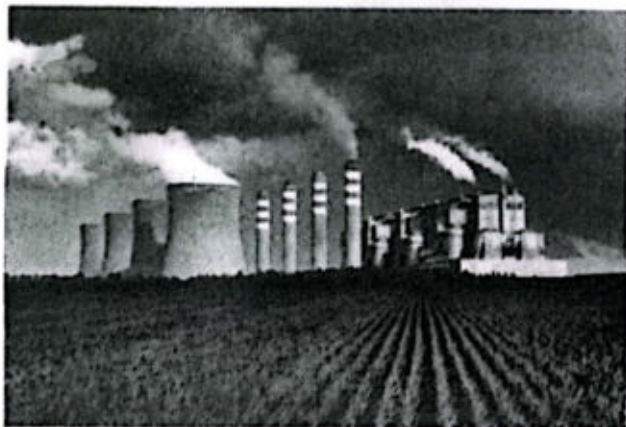


Fig. 6.15: Burning of coal

B. Petroleum Oil

The liquid fossil fuel is called petroleum oil. This oil can be converted into different forms by some chemical processes. The crude oil undergoes refining process (in oil refineries) to yield various energy products, including gasoline, jet fuel and kerosene oil etc. Despite the limited global reserves of oil, it is favoured over coal due to its high energy output for the same quantity and producing relatively low pollution. Oil is usually drilled and extracted from the underground reserves. Petroleum oil is used as fuel in automobile, industries and domestic uses. The petroleum reserve and using of gasoline (petrol) for vehicles are shown in figure 6.16.



Fig. 6.16: Petroleum oil

C. Natural Gas

Natural gas is a gaseous fossil fuel which is a mixture of gases mainly consists of methane gas. It is often a by-product of oil extraction. The major advantage of natural gas is its ease of transportation through gas pipelines. Natural gas is usually drilled and extracted from the underground reserves. Natural gas is used as fuel in automobile, industries and domestic uses. In all fossil fuels the main process is the combustion in which they burn and produce heat which is used to generate electric and mechanical energy. Domestic use and transportation of natural gas are shown in figure 6.17.

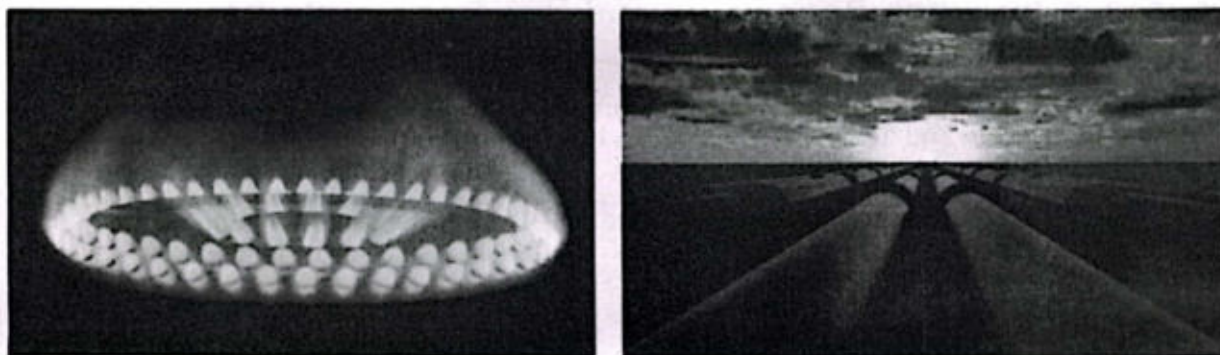


Fig. 6.17: Natural gas

D. Nuclear Fuel

Nuclear energy is often considered a non-renewable energy source, even though nuclear energy itself is renewable. The material used in nuclear power plants like uranium is not renewable, that is the reason we called nuclear fuel as non-renewable. As a nuclear fuel heavy nucleus are used to produce energy. When these nuclei split into lighter nuclei they release a huge amount of energy (mainly heat) and radiations. This heat produced in such reactions is used to run the turbines to generate electricity. Although nuclear energy is the most efficient source of energy among all sources they produce radioactive (a material which emits harmful radiations and particles) waste, which is highly toxic and cause severe health issues like cancer, skin burn, infertility and bone decay. Pakistan also uses nuclear fuel to produce energy. Pakistan's atomic energy commission's nuclear power plant is shown in figure 6.18.

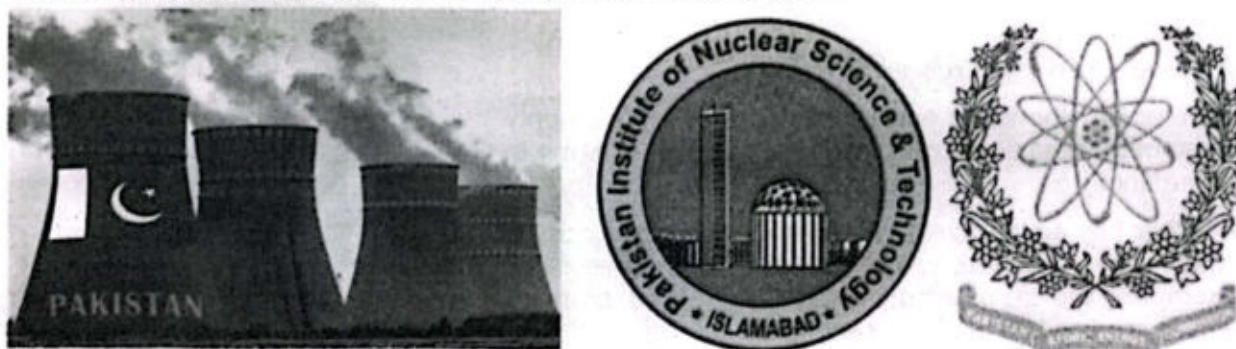


Fig. 6.18: Pakistan's nuclear power plant

In using non-renewable energy resources which produce many adverse effects on our environment it is important to make a balance between the energy requirements and the environmental and social concerns.

In general the environmental effects include:

- Emission of greenhouse gases and the air pollutants, especially when fuel is burned.
- Use of water resources to produce steam, provide cooling and as moderator in nuclear reactors.
- Discharge of pollution into water and air.
- Generation of solid waste, which may pollute the soil, water and air.
- Effects on plants, animal and ecosystem resulting from land, water and air pollution.

Difference between Renewable and Non-Renewable Resources

	Renewable resources	Non-renewable resources
1	The source which can renew itself or can be used again and again.	Sources that cannot be reused once they are destroyed are called non-renewable resources.
2	But renewable resources are replenished naturally over relatively short period of time it is present in unlimited quantity.	These are consumed million of the years to make so these are used limitedly.
3	It has low carbon emission and hence employment friendly.	These are not environment friendly and carbon emission is high.
4	Large land area is required for installation of these plants.	Less land area is requirement of installation of these plants

6.2 ADVANTAGES OF RENEWABLE ENERGY

- 1) Renewable energy emits no or low air pollutants. That's better for our health. Renewable energy does not impact air quality during operations. Renewable energy based system is the most urgent and efficient way to tackle air pollution.
- 2) Renewable energy emits no or low greenhouse gases. That's good for the climate.
- 3) Prices are more stable and secure in Renewable energy. That's good for keeping energy prices at affordable levels.
- 4) Renewable Energy Creates New Jobs.
- 5) Sources of renewable energy are inexhaustible (supply of something unable to be used up because existing in abundance)
- 6) Another key advantage of renewable energy sources is that they originate from natural resources. For example, the sun, wind, water cycle, and biomass waste are used to produce renewable energy.
- 7) Economic benefits are energy savings, energy prices, energy access, health and well-being, air quality, emissions savings household's savings. Huge profits can be generated in the mining of the coal selling of the oil or construction of the natural gas pipelines. These resources are easy to use whether in the home or anywhere else.

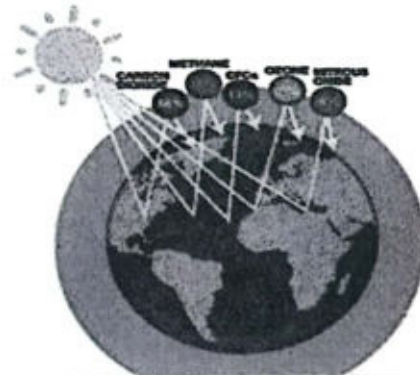


Fig. 6.19: Disadvantages of Renewable energy

Disadvantages of renewable energy

- 1) Renewable energy is not always available 24/7. Although sources of renewable energy rely on natural resources for example, if the weather is poor and the sun doesn't shine.
- 2) Similarly, if the force of the wind isn't strong enough, then onshore and offshore wind farms

Greenhouse gas emissions increased 70 percent between 1970 and 2004. Emissions of carbon dioxide, the most important greenhouse gas, rose by about 80 percent during that time. The amount of carbon dioxide in the atmosphere today far exceeds the natural range seen over the last 650,000 years.

that generate renewable energy cannot work optimally.

- 3) Additionally, with hydropower, if the water levels are not strong enough or there is a drought, this will affect the energy produced.
- 4) Initial costs for renewable energy installations are high.

6.3 THE PHENOMENON OF GREENHOUSE EFFECT AND ITS IMPACT ON CLIMATE.

Greenhouse Effect

The greenhouse effect happens when gases in the air, called greenhouse gases, trap heat from the sun. These gases act like a cozy blanket around Earth, keeping it warm. During the day, the sun heats up the Earth, but at night, when it cools down, some of that warmth tries to escape back into space. Greenhouse gases, like water vapor, carbon dioxide, methane, and ozone, prevent all the heat from escaping, making sure the Earth stays warm enough for life to bloom. Basically greenhouse effect is a warming of Earth's surface and the air above it. It is caused

Plant a tree or a garden. Plants use photosynthesis to remove carbon dioxide from the atmosphere.

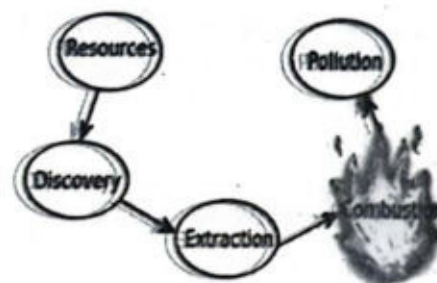


Fig. 6.20: Fossil Fuel Life Cycle

by gases in the air that trap energy from the Sun.

These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapor, carbon dioxide, and methane.

Causes of Greenhouse Effect:

1. Burning of Fossil Fuels:

Fossil fuels such as coal and oil are utilized for transportation and electricity generation, leading to the emission of carbon dioxide into the atmosphere, contributing to greenhouse gases. Combustion refers to the rapid reaction of a substance with oxygen, resulting in the generation of heat. This process is essential for the accelerate of aircraft and rockets.

2. Deforestation

Chopping down trees means there are fewer plants to take in carbon dioxide. This makes more greenhouse gases stay in the air, heating up the Earth. Deforestation is when forests are cleared for things like farming, cities, or mining. Humans have been cutting down trees a lot since 1960, which hurts nature, animals, and makes the planet hotter.



Fig. 6.21: Deforestation

3. Farming

When we use fertilizers, they let out nitrous oxide, which is another greenhouse gas, into the air. Making fertilizers also gives off other gases that trap heat, like nitrous oxide and methane. These gases are much stronger than carbon dioxide at warming the planet. Fertilizers make way more emissions when we use them than when we make them.



Fig. 6.22: Farming

4. Factories and landfills

Factories and landfills let out gases like carbon dioxide and methane, which add to the greenhouse effect. When stuff in landfills rots, it releases methane gas. Methane is really good at trapping heat from the sun, much more than carbon dioxide. Landfill gas is mostly methane, along with some carbon dioxide, made by tiny organisms breaking down trash.



Fig. 6.23: Landfill

In summary, the greenhouse effect, caused by human activities like burning fossil fuels and deforestation, leads to global warming and depletion of the ozone layer, which can have serious consequences for the environment and our health.

6.4 IMPACT OF GREEN HOUSE ON CLIMATE

Greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) trap heat in the Earth's atmosphere, causing different climate changes. Following are impacts of Green house on Climate.

1. Global Warming

Greenhouse gases act like a blanket around Earth, trapping heat and raising temperatures worldwide. This overall warming trend is called global warming.

2. More Extreme Weather

Higher temperatures increase extreme weather events like hurricanes, heatwaves, droughts, and heavy rainfall. Warmer oceans make hurricanes stronger, while drier conditions can lead to more wildfires.



Fig. 6.24: Global Warming

3. Melting Ice and Rising Sea Levels

As temperatures rise, polar ice caps and glaciers melt. This adds more water to the oceans, causing sea levels to rise and leading to coastal flooding. The loss of ice also reduces Earth's ability to reflect sunlight, which speeds up warming.

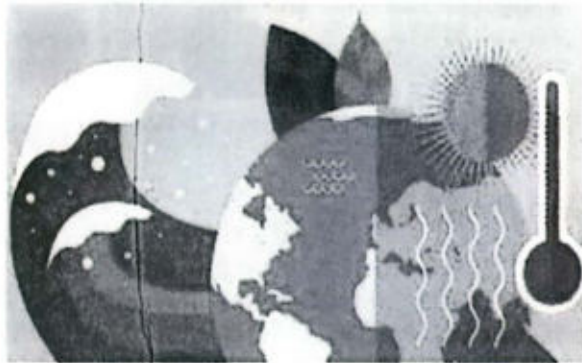


Fig. 6.25: Extreme Weather



Fig. 6.26: Melting Ice and Rising Sea Levels

4. Ocean Changes

Oceans absorb a lot of CO_2 , making them more acidic, which harms marine life, especially creatures like corals. Warmer oceans also change the natural habitat for many fish and other sea animals.

5. Threats to Animals and Ecosystems

Climate change disrupts ecosystems, forcing animals to move, adapt, or face extinction. Species that can't adapt may die out, affecting food chains and ecosystems and reducing biodiversity.



Fig. 6.27: Ocean Changes



Fig. 6.28: Threats to Animals and Ecosystems

6. Impact on Agriculture and Food Security

Climate changes affect crops, livestock, and fish, disrupting food supplies. Regions that depend on farming and fishing are especially affected, creating food shortages.

7. Health Risks for People

Higher temperatures and poor air quality increase health risks, like heat exhaustion and breathing problems. Warmer climates also allow diseases like malaria and dengue fever to spread more easily.



Fig. 6.29: Impact on Agriculture and Food Security



Fig. 6.30: Health Risks for People

6.5. SMOG AND HUMAN HEALTH

Smog is a mixture of smoke and fog that occurs when gases such as nitrogen and sulphur oxides mix with chemicals in the air. It can be caused by human activities like car emissions, industrial processes, agricultural fires, and natural phenomena.

Effect of smog on human health and environment

Smog is a form of air pollution that reduces visibility and occurs when pollutants from factories, cars, and other sources combine with sunlight and heat. It is harmful to people, animals, and plants, causing discomfort in the eyes, nose, and throat, as well as coughing, breathing, and potential asthma attacks. Additionally, smog can induce headaches, dizziness, and eye irritation, posing risks for accidents on roads and in the sky. It increases allergies and respiratory conditions, making it especially difficult for individuals with asthma to breathe.



Fig. 6.31: Smog

When rain mixes with greenhouse gases, it becomes acid rain. This acidic rainwater carries pollutants and falls into rivers, streams, and lakes, making them acidic too.

6.6. SIGNIFICANCE OF GREENING EDUCATION

Environmental education is like a guidebook that helps us navigate the complex world of environmental problems. It shows us the importance of understanding these issues, like pollution and deforestation, and how they impact our planet and all living beings. Through environmental education, we learn not only about the problems but also about the solutions available to us.



Fig. 6.32: Greening Education

Sustainability education teaches us about the concept of meeting our needs without compromising the ability of future generations to meet theirs. It helps us realize how our everyday choices, such as the products we buy and the energy we use, can either harm or help the environment. Green education takes this a step further by encouraging us to actively engage with environmental issues or adopting eco-friendly practices in our daily lives. Through green education, we not only understand the problems and solutions but also become able to share our knowledge and inspire others to join us in creating a more sustainable world.

Amazing Facts The environment around us is full of amazing features and facts you might not know. The world has over 3.04 trillion trees in the world. About 71% of the earth is water. Seventy-eight percent of marine mammals are at risk of accidental deaths, such as getting caught in fishing nets.

6.7 GREENING SKILLS

Green skills are what we need to make the world cleaner and healthier. They involve using resources wisely, promoting eco-friendly practices, and protecting the environment. These skills are essential for tackling big problems like climate change and pollution, and they're crucial for creating a more sustainable future. "Greening" means making our surroundings eco-friendly by planting trees, crops, and plants in our communities and parks. Green skills are what we learn to use eco-friendly technologies effectively. They help us solve environmental issues and find better ways to grow. These skills teach us how to care for nature, save resources, and maintain a stable climate. Learning them is important for keeping both people and the planet healthy.

Greening skill is about critical thinking, problem-solving, and decision-making, all within the context of sustainability. They are about empowering individuals to make informed decisions that benefit not just the environment, but society and the economy too.

Do You Know?

Studies have shown that talking to plants can actually help them grow faster.



Objective of green environment

1. To make a pollution free earth.
2. To create environmental awareness, among the people.
3. To aware and educate the people for plantation the trees and about protection the environment.
4. Distribution of the trees free of cost and public place, like school, college, cinemas rail and bus station, market etc.

STEAM ACTIVITY 6.1

Project on greening education

Design a project where you create a sustainable school garden. In your project, first research the benefits of sustainable gardening and then design a garden layout that includes features like compost bins and water containers.

How will you prepare the site, plant various native species, and set up educational displays to inform others about sustainable practices?

Finally, reflect on what you have learned from this project and describe how you would share this knowledge with your school community.

6.8 GREEN SKILLS WITH 21ST CENTURY SKILLS AS A PATHWAY TO THE FUTURE.

Green skills and 21st-century skills both walk to the way for the future, but they focus on different aspects. 21st-century skills are about being kind, understanding others, and working together, which are important for making the world a better place. These skills, often called the 4-C's (thinking carefully, being creative, communicating, and collaborating), help students succeed not only in school but also in life. They involve deeper learning, like problem-solving and teamwork, and go beyond just knowing facts.

Green skills are the knowledge, abilities, values, and attitudes needed to live in, develop and support a sustainable and resource-efficient society.

On the other hand, green skills are specifically moving towards understanding and protecting the environment. They teach us how to use eco-friendly technologies effectively and solve environmental problems. Both sets of skills are important for preparing students for the future and ensuring a healthy planet and society.

6.9. CHANGES IN ATMOSPHERIC PRESSURE WITH ALTITUDE

Air is all around us, but we cannot see it. Gravity from the Earth pulls air down - this is called air pressure. We don't feel this pressure because our bodies push an equal amount of pressure outward.). Barometers are used to measure air pressure.

Do You Know?

If the total atmospheric pressure were lower, the climate forcing of greenhouse gases would be smaller, the magnitude of the greenhouse effect would be less, and the global mean temperature would drop.

As we go higher up on Earth, the air becomes lighter and the air pressure gets lower. This happens because there's less air above us the higher we go. The weight of the air around us creates air pressure. When we're on top of a mountain, there's less air above us, so the pressure is less. This means that as we climb higher, there's less air pushing down on us, making the air pressure lower. And when we go lower down, there's more air above us, so the pressure is higher.

Understanding how atmospheric pressure changes with altitude helps us to understand natural phenomena.

Examples of Pressure Changes with Altitude:

Mountain Climbing: Climbers often feel the effects of lower pressure at high altitudes. The air is "thinner" meaning there is less oxygen to breathe, which can lead to altitude sickness.

Airplane Travel: Aircraft cabins are pressurized because, at around 35,000 feet the atmospheric pressure is so low that without pressurization, it would be difficult for passengers to breathe normally.

Weather Systems: Atmospheric pressure also influences weather. High-pressure areas tend to bring clear skies, while low-pressure areas can lead to storms and rain.

Interesting Facts

Rapid Decrease: Atmospheric pressure drops by about 50% for every 5.5 kilometers (18,000 feet) you ascend above sea level. This means that at an altitude of 5.5 km, the pressure is half of what it is at sea level.

Boiling Point Drops: As atmospheric pressure decreases with altitude, the boiling point of water also drops. For instance, at 3,000 meters (about 9,800 feet), water boils at around 90°C (194°F) instead of 100°C (212°F) at sea level.

Altitude Sickness: At altitudes above 2,500 meters (8,200 feet), the drop in atmospheric pressure can cause altitude sickness, with symptoms like headaches, nausea, and dizziness, due to the body struggling to get enough oxygen.

6.10. CREATION OF SOLAR OVEN AND IDENTIFY THE SCIENTIFIC CONCEPT INVOLVED IN IT. [STEAM]

Solar ovens use sunlight to make heat for cooking. They have shiny surfaces, like aluminium foil, that trap the sunlight and turn it into heat.

Concentrating Sunlight

To concentrate and channel light from the sun into a tiny cooking space Sunlight can be greatly focused to become much stronger. The sunlight can be concentrated by multiple orders of magnitude.

Converting Light Energy to Heat Energy

A receiver, such as a cooking pan, receives the concentrated sunlight. The interaction of light energy with the receiver material aids in the conversion of light to heat. The conversion rate is increased by using heat-conducting and heat-absorbent materials.

Working Principle of a Solar Oven

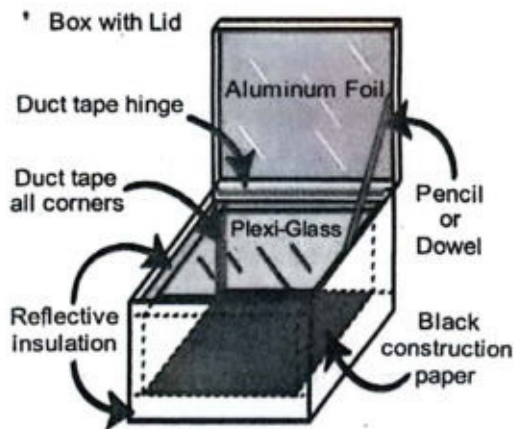
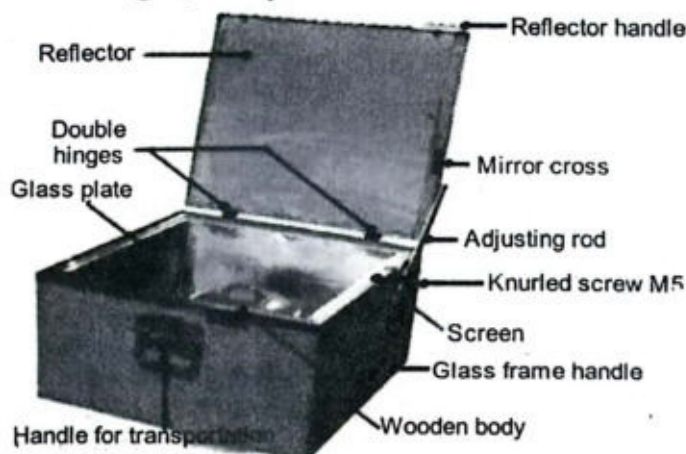


Fig. 6.33: Working Principal of Solar Oven

Trapping Heat Energy

By isolating the air inside the oven from the air outside using a glass lid on the pot increases light absorption from the top of the pan, and improves the oven's heat holding ability. The

glazing allows infrared thermal rays to pass through but is **opaque** (muddy or cloudy) to incoming sunlight.

Uses of a solar Oven

A solar Oven is a device that heats, cooks, or other foods using the energy of direct sunshine. A solar oven is used for water distillation. It is used for roasting coffee and peanuts for commercial purposes. It is also used for melting wax.

Concentrating Sunlight

A mirror surface is used to concentrate and channelize light from the sun into a small cooking space. The sunlight can be concentrated by several orders of magnitude, producing magnitudes high enough to melt salt and metal. For household solar cooking applications, such high temperatures are not required. Solar cookers available in the market are designed to achieve temperatures of 65°C to 400°C .

Converting Light Energy to Heat Energy

The concentrated sunlight is focused onto a receiver such as a cooking pan. The interaction between the light energy and the receiver material helps to convert light into heat by a process called **conduction**.

Box-Type Solar Oven

The most used form of solar cooker is the box-type solar cooker. In this section, we will be discussing the construction and working principle of a box-type solar cooker.

A box-type solar cooker consists of the following components:

- **Black Box** - The box is an insulated metal or wooden box which is painted black from the inside to absorb more heat.
- **Glass Cover** - A cover made of two sheets of toughened glass held together in an aluminium frame is used as a cover for box B.
- **Plane Mirror reflector** - The plane mirror reflector is fixed to box B with the help of hinges. The mirror reflector can be positioned at any desired angle to the box. The mirror is positioned to allow the reflected sunlight to fall on the glass cover of the box.
- **Cooking Containers** - A set of aluminium containers blackened from the outside are kept in box B.

The solar Oven is placed in sunlight and a plane mirror reflector is adjusted in a way such that the strong beam of sunlight enters the box through the glass sheet. beam of sunlight and the heat produced raises the temperature of a metal surface to about 100°C .

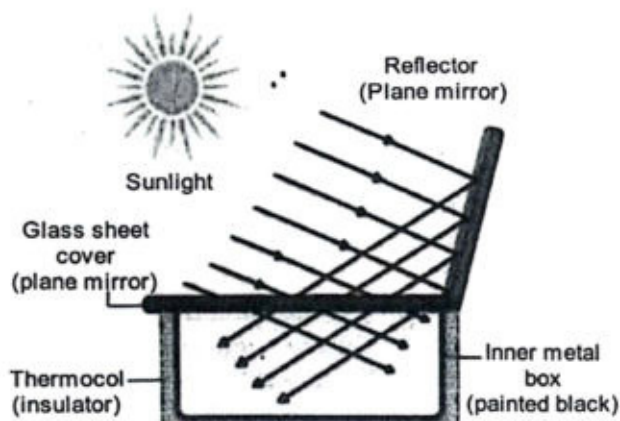


Fig. 6.34: Solar Oven

Advantages and Disadvantages of Solar Oven

Advantages

1. Solar Ovens use no fuel. No requirement of cooking gas or kerosene, electricity, coal or wood.
2. This saves cost as well as the environment by not contributing to pollution.
3. Cooking without gases that make air dirty can help make our planet cleaner.
4. Food cooked in solar cooker is nutritious. ...
5. Solar cooking is pollution free and safe.
6. Solar cookers come in various sizes.
7. Many solar ovens are designed to be portable are suitable for camping outdoor activities and they're lightweight also.

Solar energy can be considered pollution-free, but the setup will cause damage to the environment.

Disadvantages and limitations of solar oven

1. Solar cookers are less useful in cloudy weather.
2. Some solar cookers take longer to cook food than a conventional stove or an oven.
3. Some solar cookers are affected by strong winds which can slow the cooking process the installation of s.
4. It might get difficult to cook some thick foods such as large roasts and loaves of bread.

STEAM ACTIVITY 6.2

In this science activity, you will build your own simple solar oven out of a pizza box to gather the sun's rays and cook a tasty treat for you!

In this activity you may make a very simple box-type solar oven, but you could build another solar oven using a more efficient design to make your solar oven get even hotter! Do some research online to find other solar oven designs? How efficient can you make a solar oven be?

SUMMARY

1. Carbon forms the essential chemical structure for all living beings on Earth.
2. We are made of carbon, consume carbon, and human activities burn fossil fuels for industry and daily life, releasing CO₂ back into the atmosphere.
3. Carbon cycle consists of mainly two processes named photosynthesis and respiration.
4. The greenhouse effect is a warming of Earth's surface and the air above it. It is caused by gases in the air that trap energy from the Sun. These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapor, carbon dioxide, and methane.
5. Smog is the result of the reaction of emissions from automobiles, factories, and industries with the sunlight and atmosphere.
6. Smog also can damage plants and trees, and reduces visibility.
7. Greening skills technical knowledge, expertise and abilities that enable the effective use of technologies and processes in professional settings.
8. Atmospheric pressure decreases with increases in the altitude. As we know that the density of air becomes heavier near the surface of the earth (due to gravity) and begins to

lighten as we go to higher altitudes and eventually leads to empty space, i.e. outside the atmosphere of the earth.

9. Solar oven is a device that uses sunlight as a source of heat for cooking foodstuffs. The solar oven is a simple, portable, economical, and efficient tool.
10. Energy resources are mainly of two types, i.e. renewable energy resources and non-renewable energy resources.
11. Coal is the debris of dead plants underground which is a solid fossil fuel and produces large amount of pollution on burning.
12. Natural gas is the gaseous fossil fuel which is used in cooking and industries.
13. Petroleum oil is the liquid fossil fuel which is used in transportation and in industries.
14. Nuclear fuel is an example of non-renewable source of energy.
15. Hydro-electric energy is a renewable source of energy in which we use the potential energy of water to produce electric energy.
16. Solar energy is a renewable source of energy in which we convert the sunlight into electricity which is a safe source of producing electricity.
17. Wind energy is a renewable source of energy in which we use the kinetic energy of wind to produce electric energy.
18. Salter's duck and Point absorber are the devices use to convert the kinetic energy of waves into electric energy.
19. Tidal barrages are constructed on sea shores to produce electric energy by using the tidal energy.
20. Renewable sources of energy are advantageous over non-renewable energy sources due to their continuous supply and they are friendly to our environment.

EXERCISE

Section I: Multiple Choice Questions

Select the correct answer:

1. Which One of the Following Is Not a Greenhouse Gas?
 A) Methane B) Hydrogen C) Nitrous oxide D) Ozone
2. Which of the Following Greenhouse Gases Is Present in very high quantities?
 A) Carbon dioxide B) Ethane
 C) Propane D) Methane
3. The source of carbon to plants in the carbon cycle is
 A) fossil fuels (B) carbonate rocks
 C) atmospheric carbon dioxide D) all of the above
4. In the carbon cycle, the human body returns carbon to the atmosphere through this way:
 (A) formation of glucose (B) waste products
 (C) photosynthesis (D) cellular respiration
5. Which one of the following Is incorrect about the greenhouse effect?
 A) Life on earth is possible due to the greenhouse effect
 B) Greenhouse effect is a natural process that maintains the earth's temperature
 C) More is the emission of greenhouse gases, more is the temperature of the earth's atmosphere
 D) Increased emission of greenhouse gases is a natural process

6. Which is Not Naturally Occurring Greenhouse Gas?
A) Nitrous oxide B) Methane C) Carbon dioxide D) Ethane
7. The two gases making highest relative contribution to the greenhouse gases are
A) CH_4 and NO_2 B) CO_2 and CH_4
C) CO_2 and N_2O D) CFCs and N_2O
8. The effect of increasing amount of greenhouse gases is
A) increase the surface temperature of the earth
B) global warming
C) depletion of ozone Layer
D) All of the above
9. Which of the following statements is true about SMOG?
A) SMOG is derived from the fog B) SMOG is derived from smoke
C) SMOG is derived from water vapour D) SMOG is derived from both fog and smoke
10. The human cell use to produce energy
A) Amino Acid B) Glucose C) Fatty Aid D) None of above
11. The largest source of commercial energy consumption in the world?
A) Nuclear B) Nuclear gas C) Oil D) Coal
12. Burning of Fossil Fuels Results In
A) Increased oxygen level B) Decreases greenhouse gases
C) Increased greenhouse gases D) Increased ethane level
13. Photocells are made of:
A) wood B) copper
C) carbon D) silicon
14. Which of the following is used in wind turbines to boost the rotating speed of the rotor shaft to a level for effective energy generation?
A) gearbox B) rotor blades
C) turbine D) generator

Section II: Short Response Questions

1. Identify the factors that affect the greenhouse effect.
2. Discuss the primary cause of the increase in greenhouse gases.
3. Write the chemical equation for photosynthesis.
4. Determine where the energy used in photosynthesis is obtained.
5. List the end products of photosynthesis.
6. Identify the part of the leaf where photosynthesis primarily occurs.
7. Identify the type of pollution responsible for smog.
8. Define atmospheric pressure.
9. Describe how smog is created.
10. List the 4Cs of 21st-century skills.
11. Differentiate between renewable and non-renewable energy.
12. Provide 5 examples of renewable and non-renewable energy sources.
13. Classify fossil fuels as either renewable or non-renewable.
14. Tides can be used to generate electrical energy. Discuss a method to convert tidal energy into electrical energy.

15. What may be the advantages of renewable energy resources?
16. Why non-renewable energy resources are considered more advantageous?
17. Describe Salter's duck? How it can be used to produce electricity?

Section III: Extensive Response Questions

1. Analyze the relationship between the greenhouse effect and global warming and evaluate their impact on the environment.
2. Explain the carbon cycle and discuss its significance in maintaining ecological balance.
3. Hypothesize what would happen if greenhouse gases were completely absent from Earth's atmosphere and assess the consequences.
4. Evaluate the harmful effects of smog and propose strategies to mitigate its impact.
5. Investigate the major causes of the greenhouse effect and assess their long-term implications.
6. Compare 21st-century learning skills with traditional learning skills and analyze their differences in preparing students for the future.
7. Examine how atmospheric pressure changes with altitude and predict the effects of these changes on weather patterns.
8. Assess the effects of environmental pollution on ecosystems and propose potential solutions.
9. Describe the function of a solar oven and explain the type of heat it utilizes to cook food.
10. Differentiate between breathing and respiration in humans and analyze how each process supports life.
11. State that biomass is a renewable organic material and support your argument with examples.