

## ENERGY EFFICIENCY

Energy efficiency is the use of less energy to perform the same task (or) produce the same result. Energy efficient homes and buildings use less energy to heat, cool and run appliances and electronic equipments.

Here are some examples of energy-efficient measures that can be implemented in buildings:

1. **Lighting:** The use of energy-efficient lighting systems, such as LED bulbs, can significantly reduce the amount of electricity required to light a building. Additionally, lighting controls such as motion sensors and timers can help ensure that lights are only used when needed.
2. **Heating, ventilation, and air conditioning (HVAC) systems:** Energy-efficient HVAC systems, such as variable refrigerant flow systems or geothermal heat pumps, can reduce energy consumption while providing high levels of comfort. Properly insulating and sealing the building envelope can also help reduce the amount of energy required to heat or cool the building.
3. **Appliances and equipment:** Energy-efficient appliances and equipment, such as Energy Star certified products, use less energy than conventional products, without sacrificing performance.
4. **Building design:** Energy-efficient building design, such as orientation, shading, and the use of high-performance insulation and windows, can significantly reduce the amount of energy

required to operate a building. The use of passive solar design strategies can also help to reduce energy consumption.

5. **Renewable energy:** The use of renewable energy, such as solar or wind power, can help buildings generate their own electricity and reduce their reliance on grid-supplied electricity.

### Benefits of Energy efficiency:

- Energy efficiency is an effective way to save money.
- Increased energy efficiency can lower greenhouse gas.
- Provides long term benefits by lowering overall electricity demand.
- Increased property value: Energy-efficient buildings may have higher property values due to their reduced operating costs, improved comfort, and environmental benefits.
- Improved reputation: Energy-efficient buildings and systems can improve the reputation of the building or organization.

### SUSTAINABLE TRANSPORTS

Sustainable transport refers to any means of transportation that is green and has low impact on the environment.



Some examples of sustainable transport:

1. **Active transport:** Walking and cycling are considered sustainable modes of transport, as they do not emit greenhouse gases and promote physical activity, which can have positive health benefits.
2. **Public transport:** Public transport, such as buses, trains, and subways, can be a sustainable alternative to private car use, as it can reduce the number of cars on the road and lower greenhouse gas emissions.
3. **Electric vehicles:** Electric vehicles (EVs) are becoming increasingly popular as a sustainable mode of transport, as they emit zero or very low levels of greenhouse gases. Additionally, the use of renewable energy sources to charge EVs can further reduce their carbon footprint.
4. **Carpooling and ridesharing:** Carpooling and ridesharing can reduce the number of cars on the road, and the associated greenhouse gas emissions and congestion.
5. **Efficient transportation systems:** Efficient transportation systems, such as intelligent transportation systems (ITS) and traffic management systems, can optimize the flow of traffic, reduce congestion, and lower greenhouse gas emissions.

Key elements of Sustainable transport:

- A. **Fuel economy:** It is a measurement of fuel use. This measures how far a car can go using a set amount of fuel. It is achieved by Making engines more efficient & Vehicles lighter and bodies more aerodynamic.
- B. **Electrification:** Most important pathway to low carbon transport
- C. **Pedal power:** Cycles reduces the carbon emission.

Advantages of Sustainable transport:

1. It creates job
2. Provides safer transportation
3. Emits less pollution
4. Promotes health
5. It saves energy
6. Saves money
7. Decrease congestion
8. Conserves land

### SUSTAINABLE ENERGY

Sustainable energy refers to forms of energy that are renewable and have a minimal impact on the environment. The most common sources of sustainable energy include solar, wind, hydro, geothermal, and biomass. These sources of energy are considered sustainable because they are constantly replenished and do not produce harmful emissions or pollutants that contribute to climate change.

One of the main benefits of sustainable energy is that it reduces our reliance on non-renewable energy sources like coal, oil, and natural gas, which are finite and contribute to greenhouse gas emissions. By using sustainable energy, we can reduce our carbon footprint and minimize our impact on the environment.

Some of the key technologies used to generate sustainable energy include solar panels, wind turbines, hydroelectric power plants, and geothermal systems. These technologies are becoming increasingly efficient and affordable, making them more accessible to individuals and businesses. In addition to reducing our reliance on non-renewable energy sources, sustainable energy can also provide economic benefits. The growth of the sustainable energy industry has created new jobs and spurred innovation in areas like energy storage and grid management.

There are many benefits to using sustainable energy. Here are some of the key advantages:

1. **Reducing greenhouse gas emissions:** Sustainable energy sources do not produce greenhouse gas emissions, which are a major contributor to climate change. By using sustainable energy, we can significantly reduce our carbon footprint and mitigate the impacts of climate change.
2. **Cost-effective:** While the initial installation costs for some sustainable energy technologies may be higher than traditional energy sources, the long-term costs are often lower. For example, solar panels can provide a return on investment over time, and wind turbines can generate electricity at a lower cost than fossil fuels.
3. **Energy security:** Sustainable energy sources are often decentralized, meaning that they can be generated locally and reduce dependence on centralized energy systems. This can increase energy security and resilience, particularly in areas prone to natural disasters or political instability.
4. **Job creation:** The transition to sustainable energy is creating new jobs in areas like manufacturing, installation, and maintenance. This can provide economic benefits for local communities and contribute to the growth of the green economy.
5. **Health benefits:** Sustainable energy sources do not produce harmful emissions, which can lead to improved air quality and public health outcomes. This is particularly important in areas with high levels of pollution.

### NON-CONVENTIONAL SOURCES

Non-conventional sources of energy, also known as renewable sources of energy, are sources of energy that are replenished naturally and can be used without being depleted. These sources of energy are often considered to be more sustainable than conventional sources of energy, such as fossil fuels. Here are some examples of non-conventional sources of energy:

1. **Solar Energy:** Solar energy is a type of non-conventional or renewable energy that is harnessed by capturing the energy of the sun and converting it into usable forms of electricity or heat. Solar energy is considered to be one of the most abundant and sustainable sources of energy available, and it is becoming increasingly popular for residential, commercial, and industrial use.

There are two primary ways that solar energy is used:

- *Solar photovoltaic (PV) systems:* Solar PV systems use solar panels to capture the energy of the sun and convert it into electricity. The panels are made up of solar cells, which are made from silicon and other materials. When sunlight hits the solar cells, it creates an electric current that can be used to power homes or businesses.
- *Solar thermal systems:* Solar thermal systems use the energy of the sun to heat water or other fluids. The heated fluid can then be used to provide hot water for homes or businesses, or it can be used to generate electricity through a steam turbine.

2. **Wind energy:** Moving air is called wind. Energy recovered from the force of the wind is called wind energy. Wind energy is generated by wind turbines, which convert the kinetic energy of the wind into electricity. Minimum speed required for satisfactory working of a wind generator is 15 km/hr.

*Wind mills:* The windmill is an old method of energy conversion. The mechanical energy produced by the windmill is used in different applications like grinding. The strike of blowing wind on the blades of the wind mill makes it rotating continuously.

*Wind turbine:* Wind turbine converts the wind energy into electrical energy by driving a generator connected to it. The wind turbine is a renewable method of electricity generation. The wind turbine technology of electric power generation is one of the most reliable, clean and inexpensive technologies used for generation of large amount of electrical power.

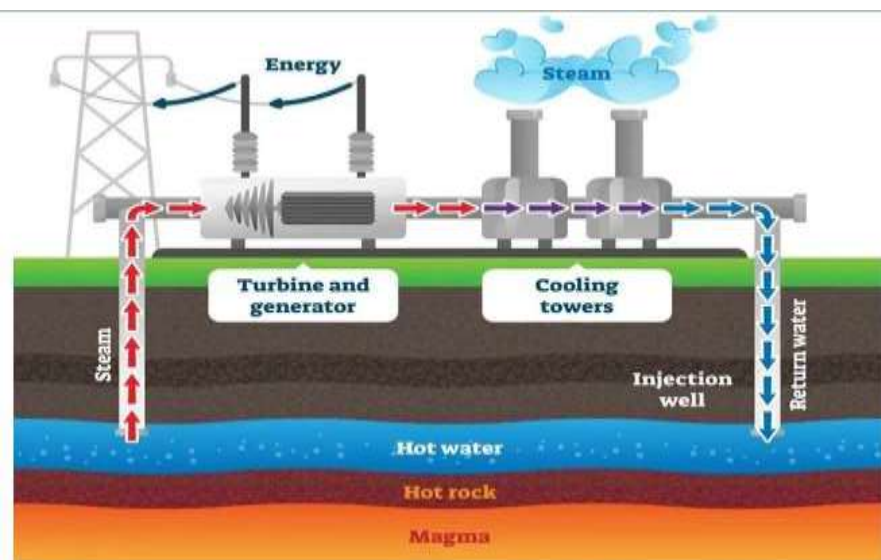
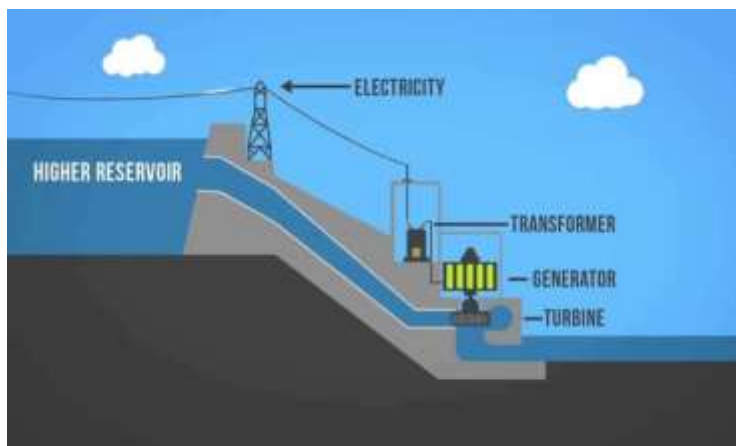
A **wind farm** is a *collection* of these wind turbines in a given location, used collectively for the generation of electricity.

Advantages:

- Reduced electricity costs: Once a wind turbine is installed, it can generate electricity for many years with very little maintenance. This can help to reduce electricity costs over the long term.
- Reduced carbon footprint: Wind energy is a clean and renewable source of energy, meaning that it does not produce harmful emissions that contribute to climate change.
- Energy independence: By generating their own electricity through wind turbines, individuals and businesses can reduce their dependence on centralized energy systems.

3. **Hydroelectric energy:** Hydroelectric energy is generated through the use of turbines, which are driven by the force of moving water. The turbines are connected to generators, which produce electricity. Hydroelectric energy can be generated from a variety of sources, including:

- *Run-of-river hydroelectricity:* This type of hydroelectricity is generated by diverting a portion of a river's flow through a channel or penstock, which drives a turbine and generates electricity.
- *Dammed hydroelectricity:* This type of hydroelectricity is generated by building a dam on a river, which creates a reservoir of water. The water is then released through turbines, which generate electricity.



4. **Geothermal energy:** Geothermal energy is generated from the heat of the Earth's core. This energy source can be used to generate electricity or to heat buildings. Temperature of the earth increases at a rate of 25°C per km when we move down from the earth surface. Geothermal resources are reservoirs of hot water that exist or are human made at varying

temperatures and depths below the Earth's surface. Wells, ranging from a few feet to several miles deep, can be drilled into underground reservoirs to tap steam and very hot water that can be brought to the surface for use in a variety of applications, including electricity generation, direct use, and heating and cooling.

5. **Biomass energy:** Biomass energy is a type of renewable energy that is generated from organic materials, such as plants and trees, agricultural and forestry residues, and animal waste. Biomass energy can be used for heating and electricity production. There are several ways to convert biomass into energy. One common method is through combustion, where the biomass is

burned to produce steam that drives a turbine to generate electricity. Another method is through gasification, where the biomass is converted into a gas that can be burned to generate electricity or used as a fuel for vehicles.

Biomass energy is considered renewable because the organic materials used to produce it can be replenished over time. It also has the potential to reduce greenhouse gas emissions when compared to traditional fossil fuels, as the carbon dioxide released during the combustion of biomass is balanced by the carbon dioxide absorbed by the plants during their growth.