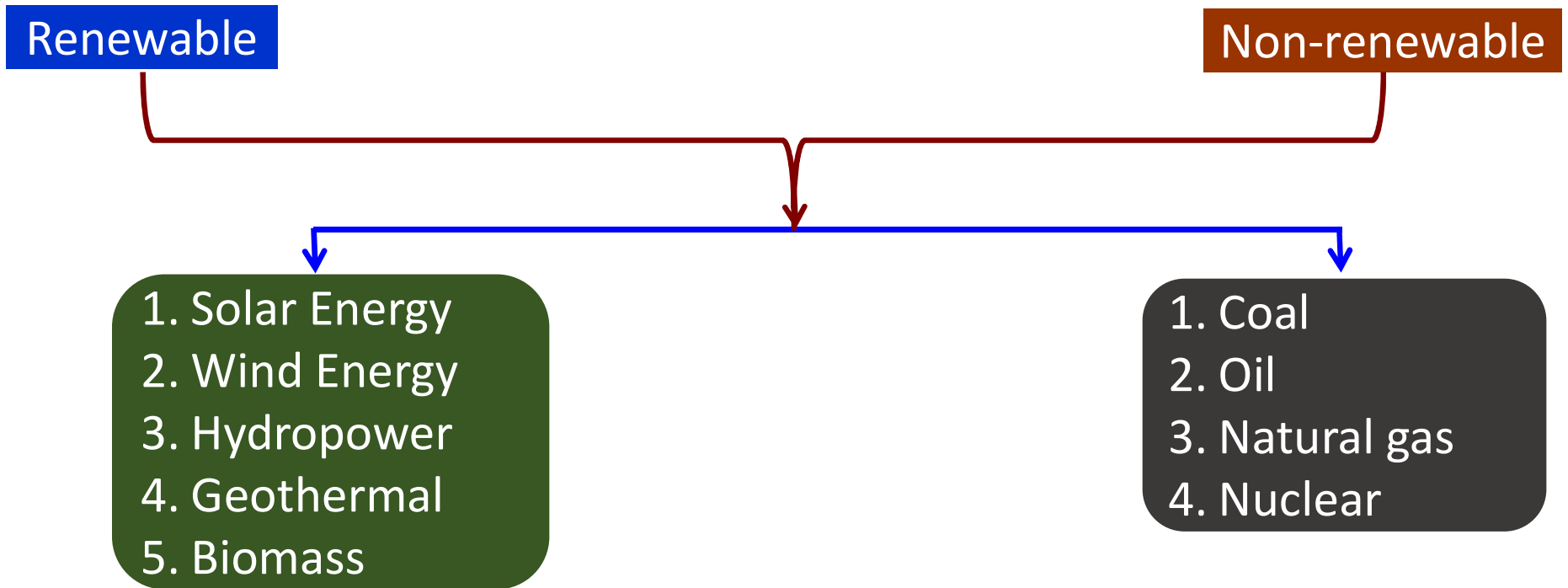




What are main types and sources of energy?



Renewable energy-Any natural energy resource that can replace itself quickly and dependably.

Non-renewable energy-Source of energy that will eventually run out. Mostly all the fossil fuels.

Main types of renewable sources of energy

1. Solar Energy

- The energy obtained directly from sunlight
- This sunlight is converted into electricity, heat and light



2. Wind Energy

- The energy is obtained from blowing air, harnessed using wind turbines
- Utilized extensively to produce electricity even at remote areas

3. Hydropower

- The energy obtained from the force of water
- Hydropower plants on large dam structures generate electricity



Lower Subansiri

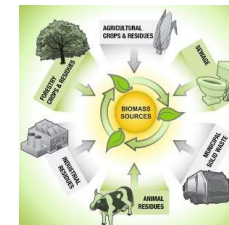


4. Geothermal Energy

- This energy is obtained from the heat generated by the Earth
- Primarily to produce electricity and can provide heat and hot water

5. Biomass

- This energy is stored in the organic matter of the earth
- Mainly used to generate electricity



Forests, Agriculture, Sewage, Solid waste, Animal residue, Industrial residue

1. Solar energy :—

Harnessing both light and heat (?) that come from the sun

The energy received from sun is the original source of most of the energy available on earth

Sun also heats the earth's surface and the Earth heats the air above it

This is the cause for winds which is also harnessed (discussed in wind energy point)

Sunlight provides necessary light and energy to plants and chromophores in the food chain

The chromophores absorb the sun's radiation and convert it into energy through a process called photosynthesis

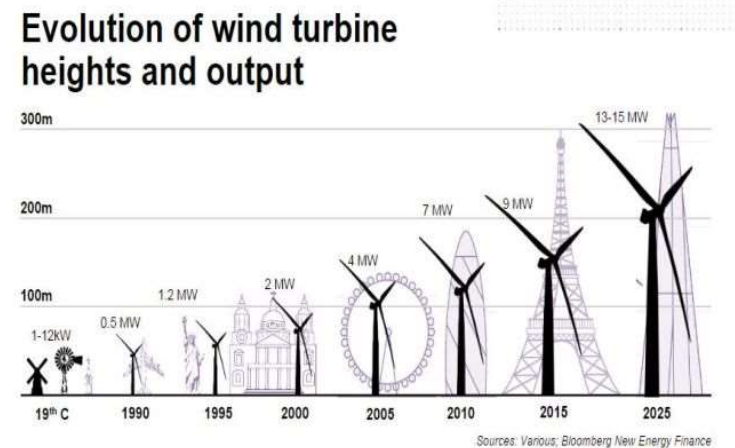
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- This photosynthesis is also responsible for all of the fossil fuels generated on Earth
- Harnessing the sun's energy in many different ways
- Among them Photovoltaic cells which convert sunlight into electricity are excellent examples of solar energy conversion devices
- Installed on roof tops, solar fields, over large water canals, etc.
- Many forms of efficient solar cells are under development and the market for these devices is growing continuously. (Silicon, DSSC, Polymer, Perovskite)
- In general there are two ways to use this sunlight to make useful forms of energy
- One is to use photovoltaic panels to make electricity (Most common)
- Second, simpler approach is to convert sunlight to heat for warming a building, making hot water, cooking, or producing "steam" that can power an electrical generator

Assignments-Solar Energy to Applications

- 1. DESCRIBE FOUR DIFFERENT TYPES OF SOLAR CELLS
 - 2. DRAW THE DEVICE ARCHITECTURE / DIAGRAMS
 - 3. ADVANTAGES AND DISADVANTAGES (04 EACH)
 - 4. PHOTOCATALYSIS OF WATER SPLITTING EXPLANATION
 - 5. STEPS AND REACTIONS OF WATER SPLITTING
-
- **SUBMISSION DATE 30 SEPTEMBER 2024**

- 2. **WIND ENERGY**: In a **wind-electric turbine**, the turbine blades capture the kinetic energy of the wind.
- The captured wind energy moves the blades or rotates the blades, which spins a shaft that is connected to a generator.
- In this way, the rotational energy is converted into electrical energy.
- Overall wind turbines convert the kinetic energy in the wind into mechanical power.
- This mechanical power can be used for grinding grains or pumping water from wells or reservoirs, or can be converted into electricity by a generator.



Working of Wind Turbines

- When wind blows, the blades/wings are lifted and begin rotating
- The attached shafts will then spin the gears that speed up the rotation of the blades (Shown in image)
- This will convert the kinetic energy of the wind into mechanical power.
- The mechanical power runs the generator
- The generator converts this mechanical power to electricity
- This is sent from the bottom of the tower to the grids and substations



Major advantages of wind energy generation

- These turbines can be installed in remote locations such as hill tops, coastal areas, deserts, off-shore in oceans as shown in the picture.
- Energy generated by these turbines are then taken to main grids from any of these remote locations.
- Low maintenance cost and ease of operation
- Long lifetime of several decades
- Can be upgraded and integrated with newer technologies
- Since the Sun heats the atmosphere unevenly, added to the diverse earth's surface (desert, water, mountains, valley and the earth's rotation around the Sun, create different seasons and strong winds. This wind energy is byproduct of the Sun.
- Suzlon that comes for placements to our campus, are a leading company for renewable energy products and solutions especially in the Wind Energy & Solar energy sector.



3. Hydro power or Hydroelectricity

It is the utilization of the force of water or in other words hydropower to generate electricity.

- Very large Hydroelectric power plants are being constructed in many parts of the world.
- Includes a large reservoir of water constructed via a dam that harnesses the energy of water falling from a great height.
- Additionally, it can also utilize the kinetic energy of flowing water as in case of run-of-the-water in large rivers for hydroelectricity generation.

Continued.....

- This does not generate lots of energy as a dam but it can continuously generate electricity.
- Hydropower in itself is non-polluting and was a preferred way to generate electricity
- Hydropower provides benefits beyond electricity generation by providing flood control, irrigation support, fish / aquatic life preservation, clean drinking water, artificial water bodies / lakes creation, etc.
- It has few disadvantages also because large dams construction may have huge environmental impacts.

4. Geothermal energy

- It is in the form of heat that is harnessed for generating electricity and heating purposes mainly.
- Obtained from reservoirs of natural hot water that exists at very different temperatures
- They are at varying depths (and heights) below the Earth's surface.
- It is considered to be very safe, reliable, available below the earth's surface, easily accessible
- They are very-economical as compared to burning fossil fuels.

Continued.....

- Geothermal energy is obtained from hot springs, lava, and fumaroles (opening of an volcano/earth).
- Fumaroles can sometimes be dangerous because they may emit poisonous gases also.
- The high temperature and pressure within the Earth's interior causes some rocks to melt.
- This melted part which is lighter than the surrounding rocks starts moving upward and is harnessed for various applications.
- Modern closed-loop geothermal power plants emit no greenhouse gases.

5. Biomass energy

It is a renewable organic material obtained from both plants and animals.

It is used for the production of both electric and/or heat energy.

This can be easily harnessed even at remote villages, hence, biomass energy generation in Indian context is very important .

Biomass has been utilized for electric power generation, heating, and also for combined heat and power generation.

Trees take in carbon dioxide from the atmosphere, convert it into biomass and when they die, it is released back into the atmosphere. This is the renewable cycle of nature.

Landfill garbages can also be cleaned up to generate this form of energy. (e.g. CopenHill-Developed by Architect Bjarke Ingels)

Continued.....

- Biomass can be converted into electric power through several methods and the most common among all is the direct combustion of biomass material, such as agricultural waste or woods.
- Other options include gasification, pyrolysis, and anaerobic digestion.
- Biorefinery process can also be used as a double resource utilization for different biomass treatment and handling methods into one system.
- This method allows the production of different components from the same biomass and hence the entire process is more viable economically and also reduces the waste generated.
- Biorefinery involves the integration of different biomass utilization and sending the feed to biomass based energy generation.
- One of the disadvantages of biomass combustion is that it produces unwanted gas / smoke emissions.

Assignment-Utilizing Biomass as an Energy Source

Explain the Combustion reaction of biomass and oxygen ? What are the obtained products of this reaction when combined in a high temperature environment?

What are the major applications that modern Biomass combustion systems are capable to produce ?

Mention three benefits and three drawbacks of modern Biomass to energy conversion technology systems.

Submission 16/10/2024, 13.00 Hrs, Hand-written, A4 sheets