18CE0406T GLOBAL WARMING AND CLIMATE CHANGE

UNIT – 5

[S1 – S3]

S1: SLO 1: Climate change negotiations

The climate negotiation process occurring through the United Nations Framework Convention on Climate Change (UNFCCC) and its related agreements is the primary forum for international cooperation on stabilizing atmospheric greenhouse gas concentrations at a level that would prevent catastrophic anthropogenic substances.

The United Nations Framework Convention on Climate Change (UNFCCC), agreed in 1992, is the main international treaty on fighting climate change. Its objective is **to prevent dangerous man-made interference with the global climate system**. The European Union (EU) and all its member countries are among the 197 Parties of the Convention.

The Intergovernmental Panel on Climate Change (IPCC) is a scientific and intergovernmental body of the United Nations (UN) tasked with providing an objective scientific assessment of climate change and its potential political, economic, social and environmental impacts.

IPCC reports support the United Nations Framework Convention on Climate Change (UNFCCC), the main international treaty on climate change that has the purpose of stabilising greenhouse gas (GHG) emissions at a level that will prevent 'dangerous' anthropogenic climate change (i.e. that caused by human activity).

An annual 'Conference of Interested Parties' (COP) assesses progress towards achieving this goal, and in December 2015 agreed the 'Paris Agreement' that set out member countries obligations to reduce GHG emissions and fund measures to mitigate the effects of climate change.

195 countries signed the agreement. This activity simulates the negotiation process that created it.

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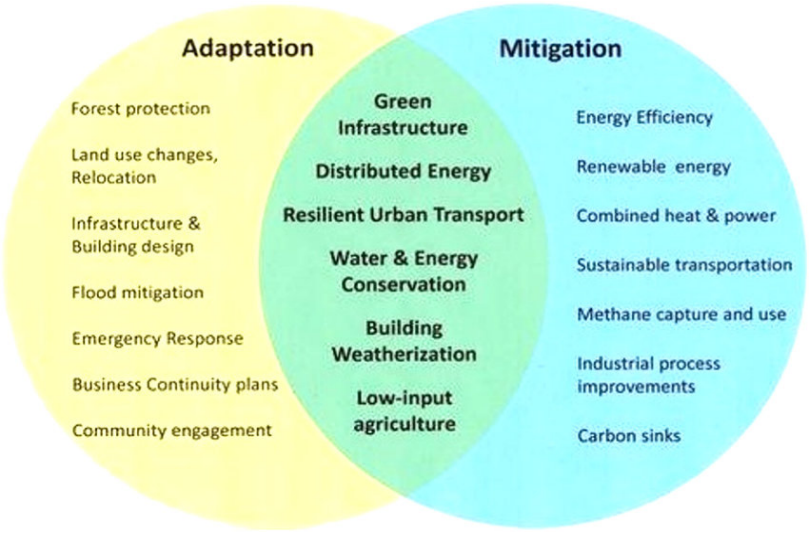
S1: SLO2: Mitigation measures

	Mitigation policy	Mitigation technology
Energy supply sector	• reduction of fossil fuel subsidies • taxes or carbon charges on fossil fuels	• switching fuel from coal to gas
Waste sector	• financial incentives for improved waste and wastewater management • renewable energy incentives • obligations and waste management regulations	• waste incineration with energy recovery • composting of organic waste • controlled wastewater treatment and recycling • waste minimization
Buildings sector	• appliance standards and labeling • building codes and certification	• efficient lighting and daylighting • more efficient electrical appliances • heating and cooling devices



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S2: Use of renewable resources

(i) Solar energy

(ii) Wind energy

(iii) Tidal energy

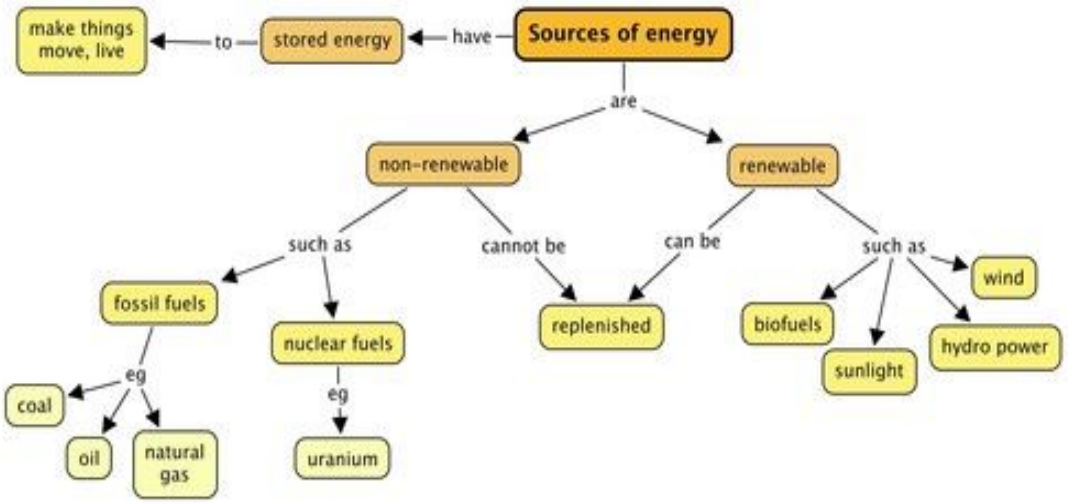
(iv) Hydrothermal energy

(v) Geothermal energy

Renewable energy is energy that is collected from renewable resources, **which are naturally replenished** on a human time scale, such as **sunlight, wind, rain, tides, waves, and geothermal heat.**

Non-renewable energy comes from sources that will run out or will not be replenished in our life times—or even in many, many life times. Most non-renewable energy sources are **fossil fuels: coal, petroleum, and natural gas**. Carbon is the main element in fossil fuels.

When we pump gas at the station, we're using a finite resource refined from crude oil that's been around since prehistoric times.



Renewable Energy Source	Non-Renewable Energy Source
Renewable Sources of Energy are those Sources of Energy which can be renewed naturally over time.	Non-Renewable Sources of Energy are those sources which are available in limited quantity..
They are replaced by nature in a short period of time	They cannot be replaced by nature
They are inexhaustible.	They will be exhausted one day
They do not cause any pollution	They cause pollution when used
Example - Solar Energy, Wind Energy	Example - Fossil Fuels, Nuclear Energy

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Solar Energy

Humans have been harnessing solar energy for thousands of years—to grow crops, stay warm and dry foods. According to the **National Renewable Energy Laboratory**, "more energy from the sun falls on the earth in one hour than is used by everyone in the world in one year." Today, we use the sun's rays in many ways—to heat homes and businesses, to warm water, or power devices.

Solar, or photovoltaic (PV), cells are made from **silicon** or other materials that transform sunlight directly into electricity. Distributed solar systems generate electricity locally for homes and businesses, either through rooftop panels or community projects that

power entire neighborhoods. Solar farms can generate power for thousands of homes, using mirrors to concentrate sunlight across acres of solar cells. Floating solar farms—or "floatovoltaics"—can be an effective use of wastewater facilities and bodies of water that aren't ecologically sensitive.

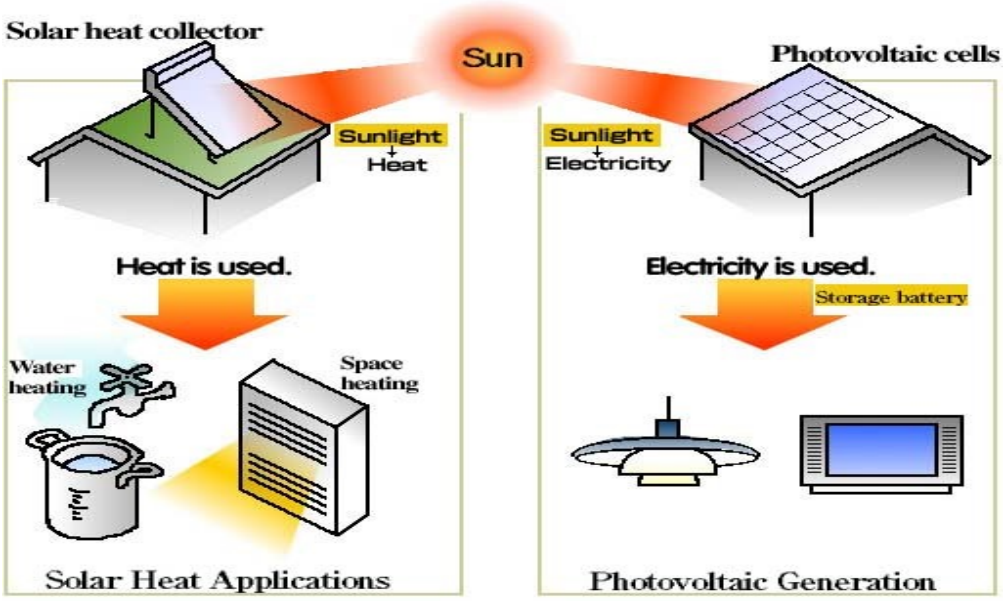
Solar supplies a little more than 1 percent of U.S. electricity generation**.** But nearly a third of all new generating capacity came from solar in 2017, second only to natural gas.

Solar energy systems don't produce air pollutants or greenhouse gases, and as long as they are responsibly sited, most solar panels have few environmental impacts beyond the manufacturing proces.

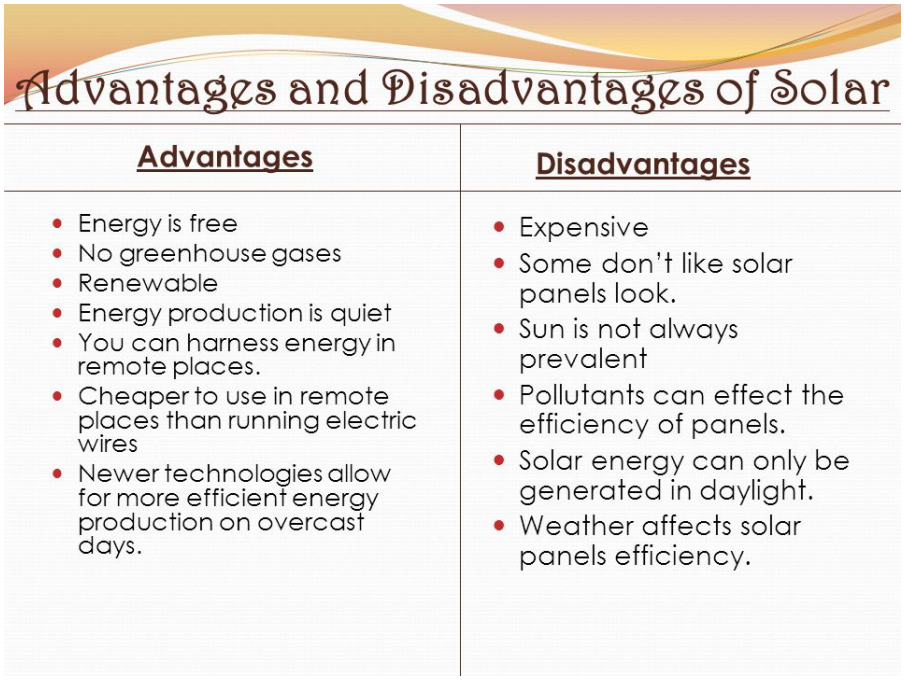
Concentrated solar power (CSP), uses mirrors to concentrate solar rays. These rays heat fluid, which creates steam to drive a turbine and generate electricity. CSP is used to generate electricity in large-scale power plants.

Solar energy corporation of India

- Installed grid connected solar power capacity is 4,229.36 MW (2015)
- Solar Thermal
- Solar PV system
- Solar concentrator
- Solar cookers
- Solar electrification for rural areas
- Solar pumping
- Solar dryers



Merits & demerits of solar energy



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Wind Energy

Wind energy is a form of solar energy. Wind energy (or wind power) describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator can convert mechanical power into electricity.

Wind power is a clean energy source that we can rely on for the long-term future. ... Because wind is a source of energy which is non-polluting and renewable, the turbines create power without using fossil fuels. That is, without producing greenhouse gases or radioactive or toxic waste.

Wind in India are influenced by the strong south-west summer monsoon, which starts in May-June, when cool, humid air moves towards the land and the weaker north-east winter monsoon, which starts in October, when cool, dry air moves towards the ocean.

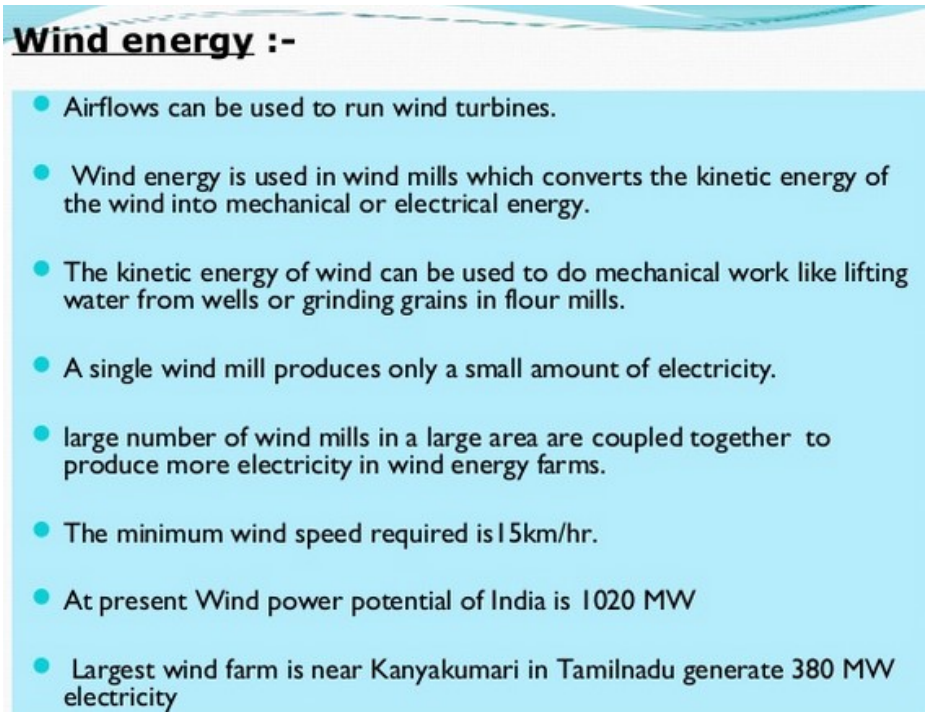
During the period march to August, the winds are uniformly strong over the whole Indian Peninsula, except the eastern peninsular coast. Wind speeds during the period November to march are relatively weak, though higher winds are available during a part of the period on the Tamil Nadu coastline.

Indian Wind Energy Association

The Indian wind energy sector has an installed capacity of **23,439.26 MW** **(as on 2015).**

In terms of wind power installed capacity, **India is ranked 5th in the World**. Today India is a major player in the global wind energy market. The potential is far from exhausted. Indian Wind Energy Association has estimated that with the current level of technology, the 'on-shore' potential for utilization of wind energy for electricity generation is of the order of 102 GW.

The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come.



Challenges of Wind Power

Wind power must still compete with conventional generation sources on a cost basis. Even though the cost of wind power has decreased dramatically in the past several decades, wind projects must be able to compete economically with the lowest-cost source of electricity, and some locations may not be windy enough to be cost competitive.

Good land-based wind sites are often located in remote locations, far from cities where the electricity is needed. Transmission lines must be built to bring the electricity from the wind farm to the city. However, building just a few already-proposed transmission lines could significantly reduce the costs of expanding wind energy.

Wind resource development might not be the most profitable use of the land. Land suitable for wind-turbine installation must compete with alternative uses for the land, which might be more highly valued than electricity generation.

Turbines might cause noise and aesthetic pollution. Although wind power plants have relatively little impact on the environment compared to conventional power plants, concern exists over the noise produced by the turbine blades and visual impacts to the landscape.

Wind plants can impact local wildlife. Birds have been killed by flying into spinning turbine blades. Most of these problems have been resolved or greatly reduced through technology development or by properly siting wind plants. Bats have also been killed by turbine blades, and research is ongoing to develop and improve solutions to reduce the impact of wind turbines on these species.

Advantages of Wind Power

(i) Wind power is cost-effective.

(ii) Wind creates jobs.

(iii) Wind enables U.S. industry growth and U.S. competitiveness

(iv) It's a clean fuel source.

(v) Wind is a domestic source of energy

(vi) It's sustainable.

(vii) Wind turbines can be built on existing farms or ranches, the energy it produces doesnot cause green house gases.

Disadvantages of Wind Power

i. Wind is not available at all times.

ii. It requires a large area of land.

iii. **A minimum wind speed of 15km/hr is required.**

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S3: Tidal energy

Tide is created due to gravitational force between earth sun and moon. Tidal energy is a renewable energy powered by the natural rise and fall of ocean tides and currents. Some of these technologies include turbines and paddles.

Although not widely used, tidal energy has the potential for future electricity generation.

Tidal power is one of the major renewable energy sources, but also one of the most infantile.

Using the power of the tides, energy is produced from the gravitational pull from both the moon and the sun, which pulls water upwards, while the Earth's rotational and gravitational power pulls water down, thus creating high and low tides.

This movement of water from the changing tides is a natural form of kinetic energy.

How does it work?

Tidal energy is produced through the use of tidal energy generators. These large underwater turbines are placed in areas with high tidal movements, and are designed to capture the kinetic motion of the ebbing and surging of ocean tides in order to produce electricity.

How Tidal energy is generated?

Tidal energy is created using the movement of our tides and oceans, where the intensity of the water from the rise and fall of tides is a form of kinetic energy. Tidal power surrounds gravitational hydropower, which uses the movement of water to push a turbine to generate electricity

How is tidal energy used today?

We can use tidal energy to supply electricity to our homes and businesses. We can use tidal energy in some places instead of burning coal and oil that contribute to global warming. Tidal generators (or turbines) work like wind turbines, except it is ocean currents, not wind, that turns them.

How does tidal energy affect the environment?

Tidal energy is a renewable source of electricity which does not result in the emission of gases responsible for global warming or acid rain associated with fossil fuel generated electricity. Use of tidal energy could also decrease the need for nuclear power, with its associated radiation risks.

Advantages of Tidal Energy

- ❖ It is an inexhaustible source of energy.
- ❖ Tidal energy is environment friendly energy and doesn't produce greenhouse gases.
- ❖ As 71% of Earth's surface is covered by water, there is scope to generate this energy on large scale.
- ❖ Efficiency of tidal power is far greater as compared to coal, solar or wind energy. Its efficiency is around 80%.
- ❖ Tidal Energy doesn't require any kind of fuel to run.
- ❖ The life of tidal energy power plant is very long.
- ❖ The large density of water, almost 1000 times greater than in air, results in very large amounts of energy to get out of the tidal currents even if the speed is low.

Disadvantages of Tidal Energy

- ❖ Cost of construction of tidal power plant is high.
- ❖ There are very few ideal locations for construction of plant and they too are localized to coastal regions only.
- ❖ Intensity of sea waves is unpredictable and there can be damage to power generation units.
- ❖ Influences aquatic life adversely and can disrupt migration of fish.
- ❖ The actual generation is for a short period of time. The tides only happen twice a day so electricity can be produced only for that time.
- ❖ Usually the places where tidal energy is produced are far away from the places where it is consumed. This transmission is expensive and difficult.

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Geotehermal energy

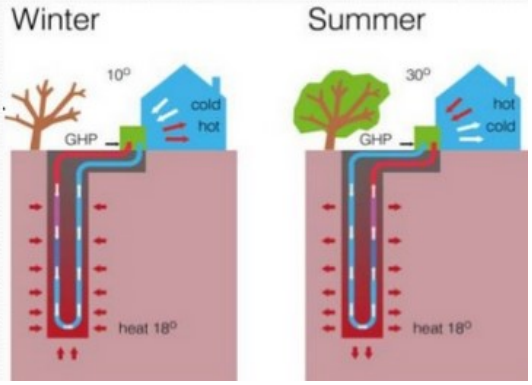
The word geothermal comes from greek word Geo- Earth and Thermal – Heat. Geothermal energy is the heat from earth. It's source lies 6500 km beneath the earth surface, core containing hot magma. Geothermal energy is a clean renewable energy resource. It accounts for 3% of the total renewable based energy electricity.

What is Geothermal Energy ?
Geothermal Energy is thermal energy generated and stored in the earth.
Thermal energy determines the temperature of the matter.
Earth's geothermal energy originates from the original formation of the Planet and from radioactive decay of minerals.

Geothermal Power Plant uses superheated water to generate electricity.
It is a most efficient way or we can say a much
better way to generate electricity because they require no raw materials and having little or no impact on the environment

Direct use of Geothermal Energy

- Hot springs, used as spas.
- Heating water at fish farms.
- Provide heat for buildings.
- Raising plants in greenhouses, drying crops.
- Provides heat to industrial processes.



Geothermal energy potential: India

- India has about 400 thermal springs distributed in 7 geothermal provinces
  - These springs are perennial and their surface temperature range from 37 to 90°C and their cumulative surface discharge is over 1000 l/m.
  - Temperature of the water at Tattapani is 90°C; at Puga (Himalaya) it is 98°C and at Tuwa (Gujarat) it is 98°C
- Estimated reservoir temperature are 120°C (west coast), 150°C (Tattapani) and 200°C (Cambay)
- The geothermal systems are mostly liquid dominated (steam dominated systems are seen in Himalayan & Sonata provinces)
- Depth of the geothermal reservoir is about 1 to 2 km
- The power generating capacity of the thermal springs is estimated at about 10,000 MW
  - Binary cycle method can be utilized to generate power
  - Puga valley (Ladakh) has the most promising geothermal field

Technologies

- Traditional/ conventional hydrothermal power production systems (geothermal power plants) types
  - Dry steam
  - Flash steam (2 types: single flash and double flash power plants
  - Binary cycle
  - Combined cycle and Hybrid
- Coproduction, Enhanced Geothermal Systems (EGS), Geo-pressured and Supercritical systems
- Direct use of geothermal heat (without involving a power plant or a heat pump)
  - Space heating and cooling, food preparation, hot spring bathing and spas, agriculture, aquaculture, green houses, snow melting and industrial uses
  - These are applied at aquifer temperatures 90-200C.
  - The geothermal water/steam is accessed and brought to a plate heat exchanger
- Ground Source Heat Pumps (GSHP)/ Geothermal Heat Pumps (GHPs) – Geothermal Heating and Cooling Systems

Geothermal Energy

Advantages

- Geothermal energy does not produce any pollution i the form of greenhouse gases.
- Running costs for a geothermal power station are very low.

Disadvantages

- It is difficult to find suitable sites to put a geothermal power station.
- If not carefully managed, a borehole can 'run out of steam' and may not be useable for several decades.
- Dangerous gases and minerals can come out of a borehole, which may be difficult to dispose of.

Hydrothermal energy

Hydrothermal energy is the process of obtaining heat or energy from a large body of water. 'Heat', in this case should not be associated with high temperature (as it may be with geothermal energy) but rather a relative heat content or relative temperature difference.

What is the source of hydrothermal energy?

Magma heats nearby rocks and underground aquifers. Hot **water** can be released through geysers, hot springs, steam vents, underwater hydrothermal vents, and mud pots. These are all sources of geothermal energy. Their heat can be captured and used directly for heat, or their steam can be used to generate electricity.

Hydropower uses a fuel—water—that is not reduced or used up in the process. Because the water cycle is an endless, constantly recharging system, hydropower is considered a **renewable energy**. When flowing water is captured and turned into **electricity**, it is called **hydroelectric** power or hydropower.

Why is hydrothermal energy important?

Hydropower is fueled by water, so it's a clean fuel source, meaning it won't pollute the air like **power** plants that burn fossil fuels, such as coal or natural gas. ... Because hydropower plants can generate **power** to the grid immediately, they provide **essential** back-up **power** during **major electricity** outages or disruptions.

Why is hydropower better than geothermal energy?

Geothermal and hydroelectric are renewable sources of **energies** and produce "clean" fuel sources. **Geothermal energy** is heat stored deep inside the earth or occasionally in hot springs. ... **Hydropower** is fueled by water and driven by the sun, therefore; it is a sustainable fuel source

Who uses hydropower the most?

Hydropower is the most important and widely-used renewable source of energy. Hydropower represents about 17% (International Energy Agency) of total electricity production. China is the largest producer of hydroelectricity, followed by Canada, **Brazil**, and **the United States** (Source: **Energy Information Administration**).

Disadvantages of Hydroelectric Energy

- Environmental Consequences. The environmental consequences of **hydropower** are related to interventions in nature due to damming of water, changed water flow and the construction of roads and power lines. ...
- Expensive. ...
- Droughts. ...
- Limited Reservoirs.