ENERGY GENERATION

Solar, Hydro, Tidal, Wind, Geothermal and Thermal.

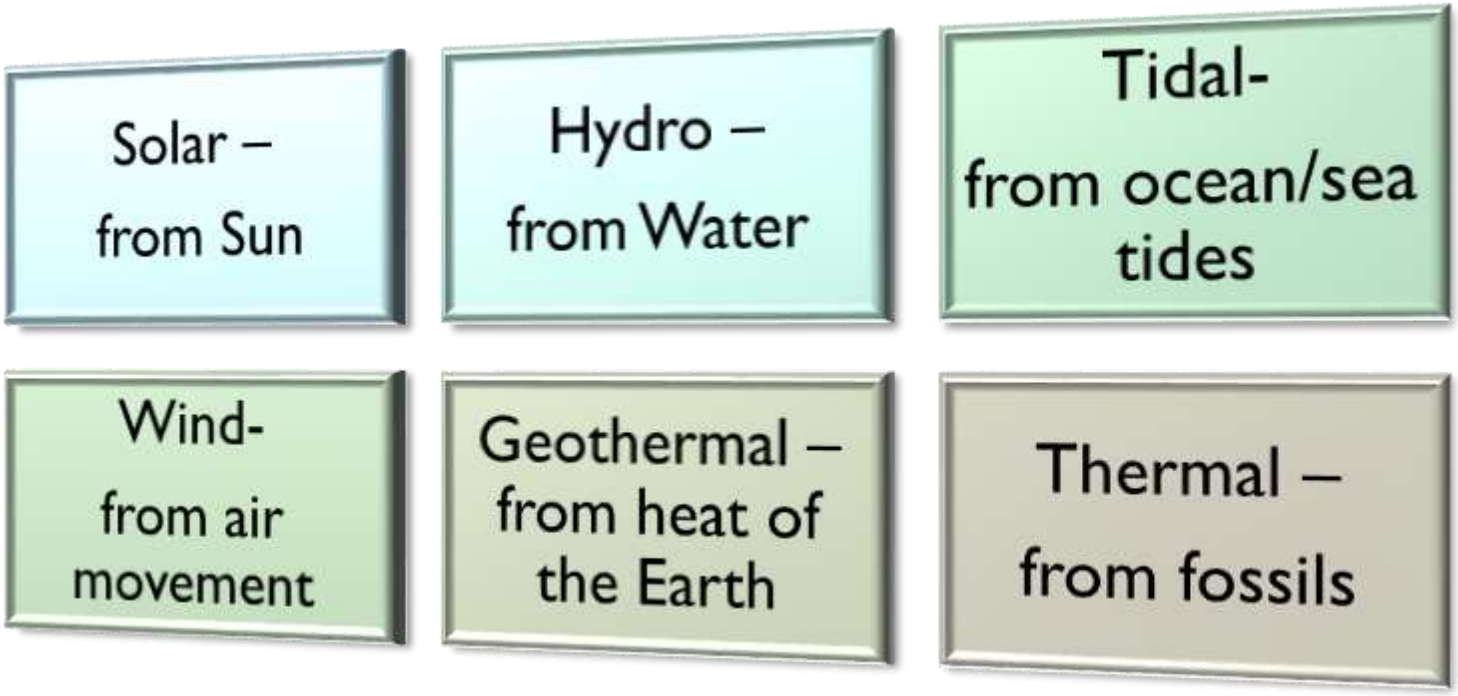
Basically What Energy Is?

- In physics, energy is the quantitative property that must be transferred to an object in order to perform work on the object.

- Energy is a conserved quantity; the Law of Conservation of Energy states that it can not be created or destroyed, but can be converted into desired form.

- We can convert energy from potential to kinetic and vice versa. For eg. Water at the top of a waterfall has stored potential energy but as the water begins to fall, energy changes to kinetic energy.

Sources Of Energy Generation



Solar Energy

Solar Energy is the energy derived from the Sun. We can convert solar energy into various useful forms of energy such as Electricity and Heat.

Intensity of Solar Energy at noon on clear day reaching Earth is nearly 1kW/m^2.

There are generally 3 ways of using solar thermal energy : Low Temperature- heating purposes; Moderate Temperature – heating water; and High Temperature – electrical power generation.

Solar Energy can be converted into Electrical Energy through the use of semi-conductor devices like Silicon known as Solar cell or Photovoltaic Cell.

A single Solar Cell produces small amount of voltage. For practical use, in order to get high voltage a large no. of solar cells are converted into series forming solar panel.

For cloudy days or night, energy can be stored in Nickel-Cadmium batteries by connecting them to solar panel.

Applications Of Solar Energy

Used to power large satellites in which Solar Panels are kept facing towards Sun.

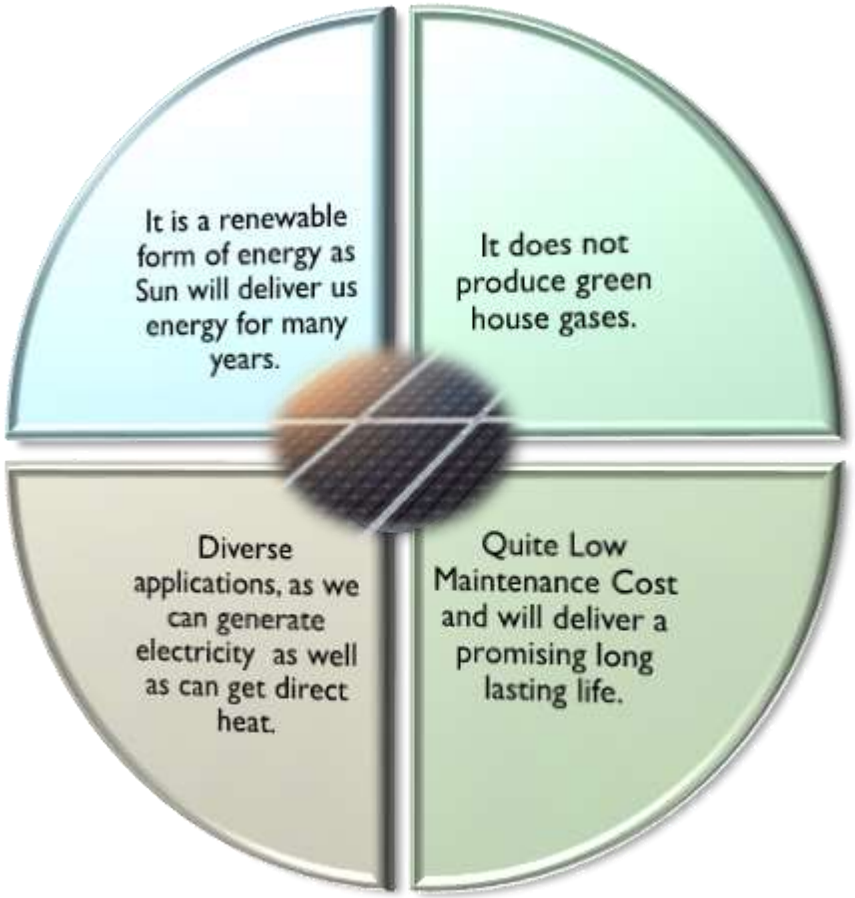
Many developed countries has introduced cars which run on Solar Energy.

Solar watches and calculators are used.

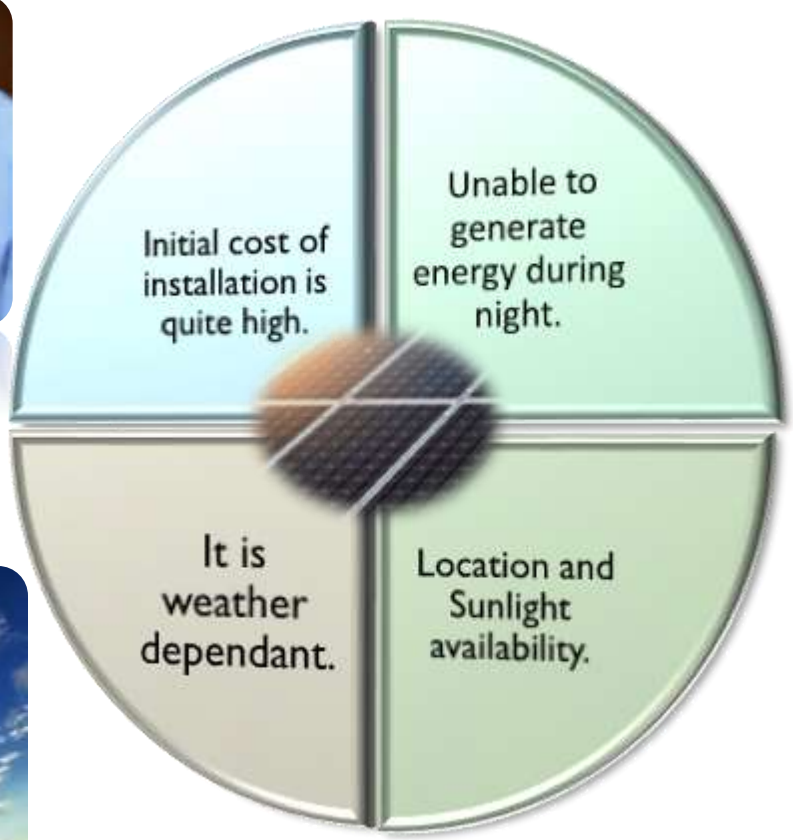
It is used in Industrial places where huge amount of electricity is required.

It provides Electrical energy to tube wells for fetching water.

Advantages Of Solar Energy



Disadvantages Of Solar Energy

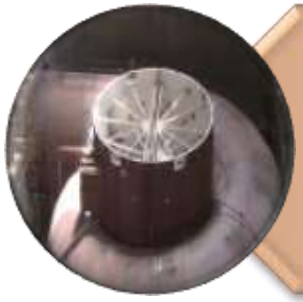


World's Largest Solar Plant

- India is one of the countries which is investing in solar energy.
- India has made an initiative of constructing World's largest Solar Park in Pavagada region of Karnataka's Tumakuru district which is in area of 13000 Acres rented from Farmers.
- The name of this Solar plant is Shakti Sathla.
- India set up this plant with an investment of Rs16,500 crores.
- This solar plant also ties in with the central government's plan of generating 2000 GW of solar power by 2020.
- Moreover, Government also pays 21000/- per month per acre to the farmers from whom the land has been rented.

Hydro Energy

Hydro Energy is produced with help of flowing water.



The turbines are is connected to an Electromagnetic Generator which produces electricity when turbines spins converting mechanical energy into electrical energy..

Hydropower holds the largest share of worldwide electricity production.

Two Main Ways Of Producing Hydro Energy

Dams

It basically uses potential energy of stored water.

Run of River

It uses natural flow of river.

What Is A Dam?

A Dam is a large barrier to raise the level of water and controls its flow.

Elevation created by dams applies gravitational force for turning turbine when water is released.

Also, reservoirs created by dams not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use and aquaculture.

What Is Run Of River?

- It is operated on the flow of river without modification by upstream storage known as run-of-river power plant.
- Generators and turbines relies on natural flow rates of rivers by diverting just a portion of water through turbines.
- Run-of-the-river hydro is used in areas where there is little or no water-storage, such as in a river.

Various Sizes Of Hydro Plants

- Hydro plants are categorized into 3 types according to their energy production.

Large Hydro (>30mW)

Small Hydro (100-30kW)

Micro Hydro (<100kW)

Advantages Of Hydro Plants

Water supply

- Dams can hold huge amount of water for future use.

Electricity Generation

- Dams can generate electricity with help of kinetic energy of stored water.

Irrigation

- Canal systems leading from dams can transfer large amount of water to great distances.

Renewable Resource

- Since water in the reservoir would be refilled each time it rains, thus it is a renewable resource unlike fossils etc.

Disadvantages Of Hydro Plants

Limited Construction

- It can only be made in limited number of places, preferably in hilly terrains.

Dam Failure

- In case of dam failures, results can be disastrous, putting life in risk of those people who leave nearby.

Environmental Problem

- Plants which submerge under the dam water, rots under anaerobic conditions and release Methane, a green house gas.

Social Conflicts

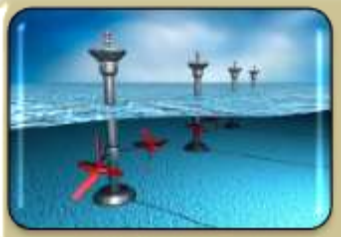
- Social problems arise due to displacement of large no. of residents living there without adequate compensatio n or rehabilitation

Tidal Energy

It converts energy from natural rise and fall of the sea or ocean tides into electricity.

Tides are caused by the combined effects of gravitational force exerted by the Moon and the Sun.

Tidal plants can only be installed along coastlines as it often experiences too high and low tides on daily basis.



It is very similar to wind turbine, the only difference is that it is under water.

The tides under water rotates turbine which is attached to a generator.

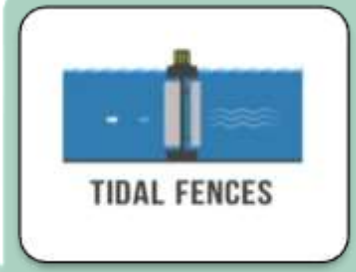
The turbine and generator converts the movement of water coming from change in tide, thus converting kinetic energy into electricity.

South Korea has installed tidal power plant having capacity of 511MW followed by France with 246MW and UK with 139MW.

3 Types Of Tidal Technologies

Tidal Barrages

- A tidal barrage is a dam-like structure used to capture the energy from masses of water moving in and out of a bay or river due to tidal forces.



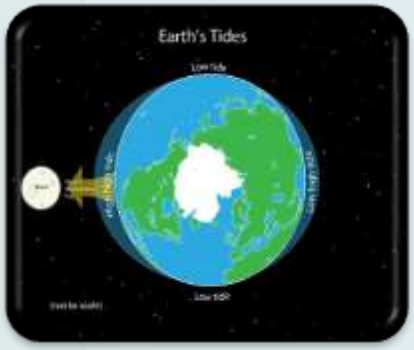
Tidal Fences

- A Tidal Fence is another form of tidal stream technology, which directly exploits fast flowing underwater ocean currents for energy generation

Tidal Turbines

- Tidal turbines are very much like underwater windmills except the rotors are driven by consistent, fast-moving currents. The submerged rotors harness the power of the marine currents to drive generators, which in turn produce electricity.

Advantages Of Tidal Energy



Tidal Energy is a Renewable energy.

This energy source is a result of the gravitational force from both the sun and the moon, combined with the earth's rotation around its axis, resulting in high and low tides.

It is possible to generate electricity at low speeds

As water has 1000 times high density than air, which helps to generate strong forces. Calculations show that power can be generated even at 1m/s.

Tidal power is an environmental friendly energy source.

In addition to being a renewable energy, it does not emit any climate gases and does not take up a lot of space.

Tidal currents are highly predictable.

High and low tide develop with well-known cycles, making it easier to construct the system with right dimensions, since we already know what kind of powers the equipment will be exposed to.

Disadvantages Of Tidal Energy

High tidal power plant construction costs.

Tidal power holds one of the heaviest up-front price tags while constructing.

It is an intermittent energy source.

As it can only provide electricity when the tide surges. This means that tidal energy can only be considered as reliable when accompanied with effective energy storage solutions.

Unable to generate cost-effective energy.

The tidal energy technology is not that cost-effective, as more technological advancements and innovations are still required to make power commercially viable

It still has some environmental effects.

The turbine frames potentially disrupt the natural movement of marine animals, and the construction of the whole plant disturbs migration of fish.

Wind Energy

A Wind Mill is a mechanical device that takes energy from the wind and converts it into electrical energy.

When blowing wind turn the blades, mechanical energy is generated which is converted into electrical energy by the generator attached to it.

Wind does not rotates the blade that fast by which electricity can be generated. So, gears are installed which increase the rotation and electricity can be generated.

Also, Brakes are installed between gearbox and generator which keeps speed limit till 80km./hr. which can be achieved during winter season.

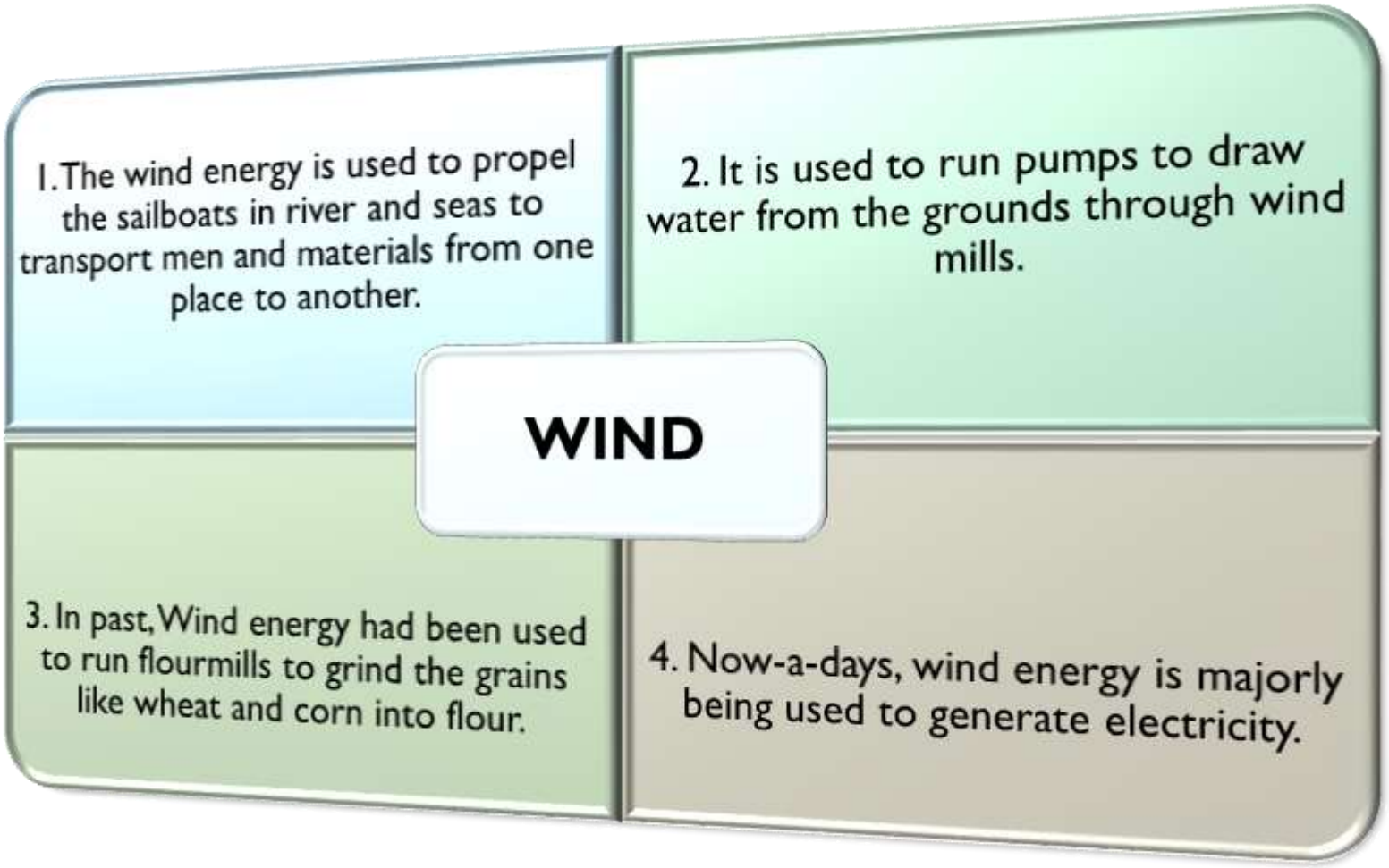
A Step-Up transformer is installed in windmill's base which gets electricity through cables from generator above attached with wind mill.

On the top of generator, wind direction sensors are installed which convey wind direction to the wind mill, after which yawing mechanism rotates windmill towards the direction of wind.

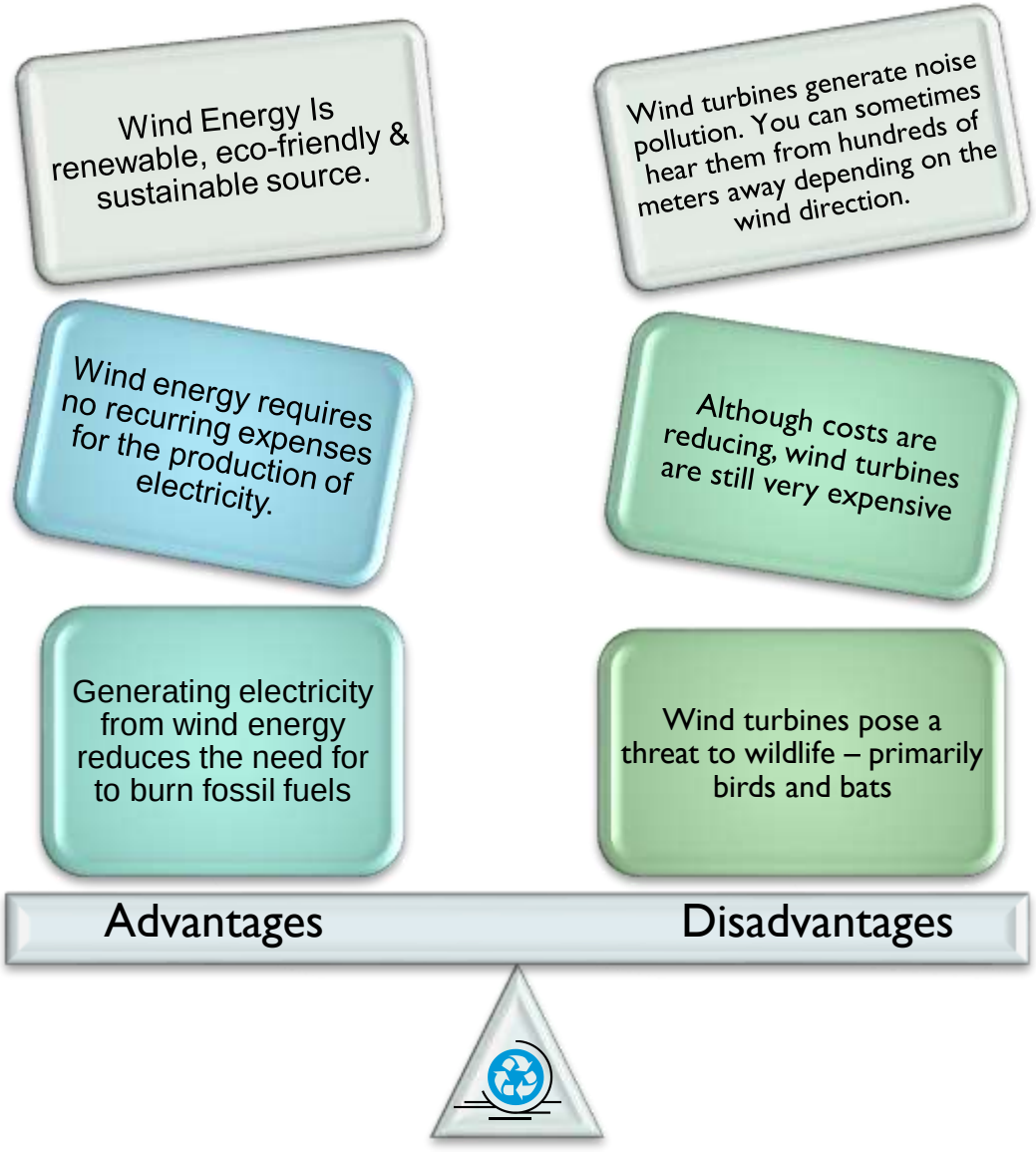
According to a scientist named Betz, we can never achieve efficiency of more than 59.3% from a wind turbine. This limit is known as Betz's Limit.

The wind speed should always be higher than 15Km./hr. to maintain required speed of the turbines.

Applications Of Wind Energy



Advantages And Disadvantages Of Wind Energy



Viewing Together Wind Energy……

So, as we discussed various pros. and cons. of wind energy. While there are many disadvantages to consider, but wind energy is one of the cleanest and most environment friendly sources of energy available today.

Although some people do not like the presence of wind turbines and their blades, this technology is key in our fight against global warming. By generating more of our power from the wind, we are able to reduce our reliance on conventional power plants that consume fossil fuels and pollute the Earth.

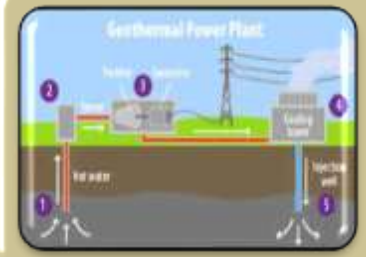
Geothermal Energy

Geothermal Energy refers to producing energy from the internal heat of the Earth, which is generated from radioactive decay of minerals and continual heat loss from Earth.

Geothermal Wells are drilled into Earth's crust at depth of 3-10 km[approx.], from where the heat is extracted with a variety of methods, mostly its drawn in form of water and steam.

Hot water is collected from the Geothermal spot in a reservoir through pipes, which converts it into steam and that the produced steam is used for heating buildings in cold regions.

Electricity Production From Geothermal…

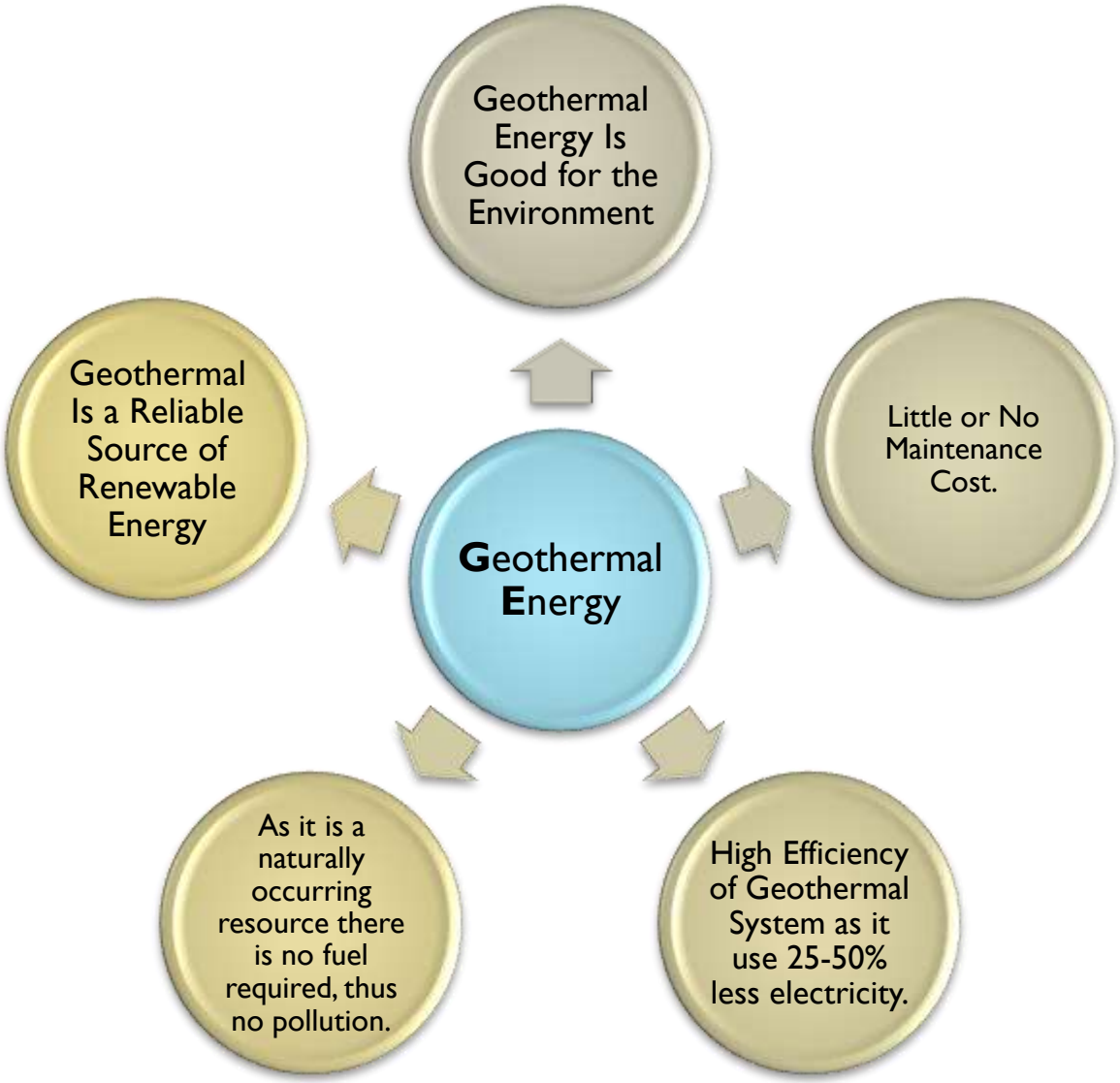


Geothermal Energy is mainly used to produce electricity by converting hot water into steam which rotates turbine which is attached to generator.

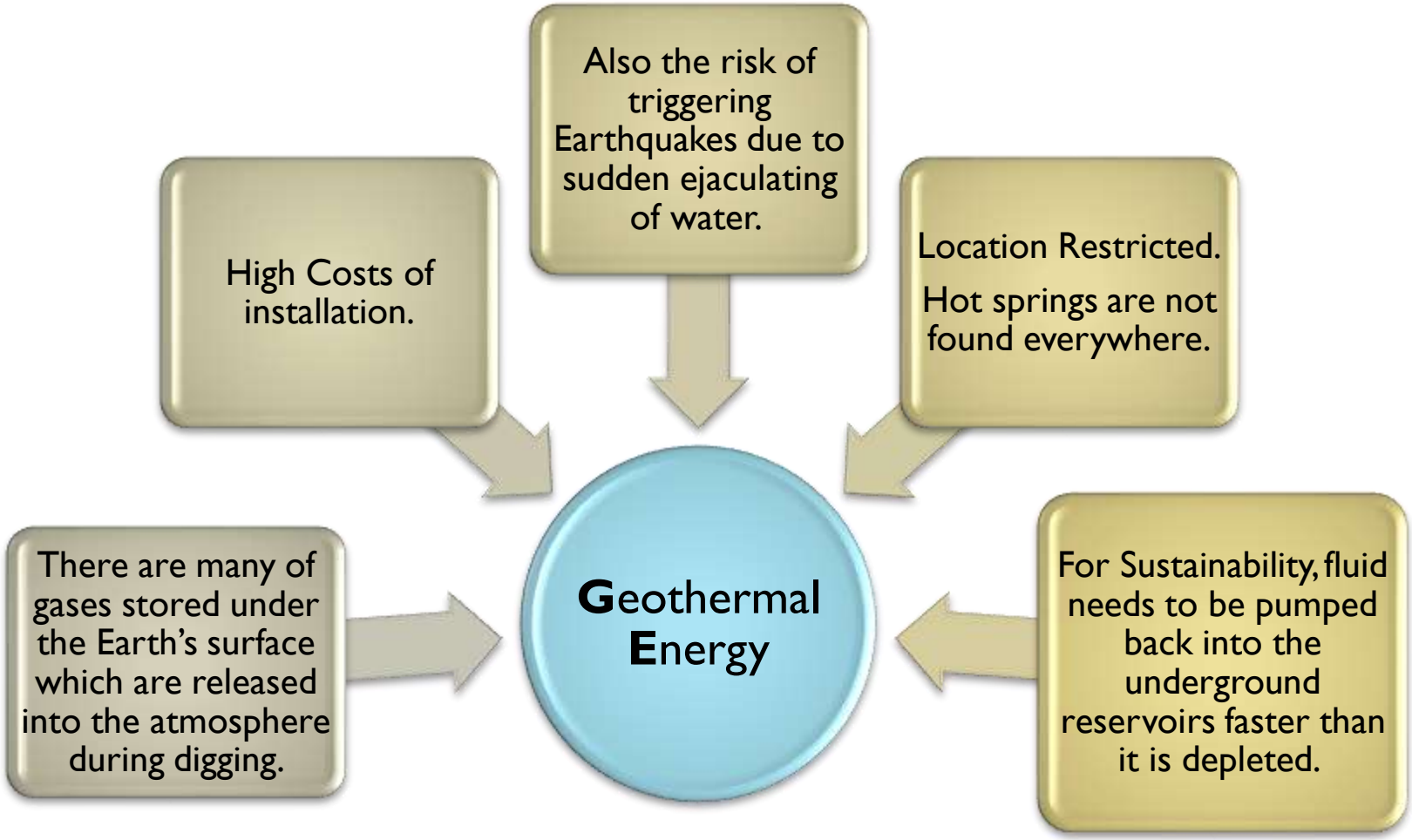
As steam rotates the turbine, a generator attached to it generates electricity.

After generation of electricity, the steam used is sent to cooling tower which converts steam into water and send it back to the ground which renews the geothermal source.

Advantages Of Geothermal



Disadvantages Of Geothermal



THERMAL ENERGY

Thermal energy (also called heat energy) is produced when a rise in temperature causes atoms and molecules to move faster and collide with each other.
The energy that comes from the temperature of the heated substance is called thermal energy.

In thermal power station, heat energy is converted into electrical power. Coal is used as fuel for heating water to convert it into steam.

Water is heated, turns into steam and drives a steam turbine which drives an electrical generator . After it passes through the turbine the steam is condensed in a condenser and recycled to where it was heated.

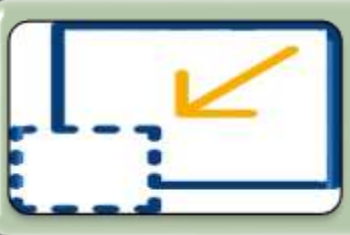
Advantages Of Thermal Energy

Less Conflicts :

Thermal project locations are generally selected in such a place where displacement of people is minimum.

Financial Cost :

Generation costs are extremely low. As coal is very cheap and the minimal energy needed to pump water to the Earth's surface can be taken from the total energy yield.



Less space required:

It requires less space for installation as compared to hydro energy plants.

Can be established anywhere:

Thermal Power Plant can be set up anywhere near fuel and water supply.

Disadvantages Of Thermal Energy

Environmental Impact :

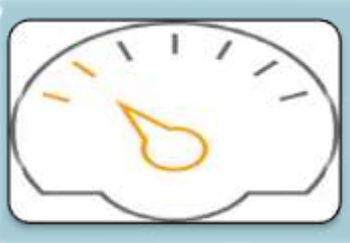
Not a renewable source of energy as it uses fossil fuels which are already less on Earth and can cause million of years to recover if vanished.

Cost Of Maintenance :

The machines and boilers in thermal plants are intricate and complicated. So, occurrence of mechanical trouble is more frequent, maintenance cost is high.

Causing Pollution :

Thermal-power plants are not environment friendly and plants emits toxic pollutants like ash, Carbon Dioxide and Sulphur Dioxide.



Overall Efficiency:

The overall efficiency of the power plant is low.

SUMMING UP……

Energy development is the field which is focused on obtaining sources of energy from natural resources.
These activities include production of conventional, alternative and renewable sources of energy, and for the recovery and reuse of energy that would otherwise be wasted.

Energy conservation and efficiency measures reduce the demand for energy development, and can have benefits to society with improvements to environmental issues.

Thank You..!

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