Fun at the Energy park

- Watch magical Rain
- Play with a mechanical Elephant
- Check your power by generating energy as you walk and slide

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Magical Rain

Take the seat under the artsy shade and relax. All of a sudden, it starts raining around you and colourful lights around the shade begin to illuminate. When you leave your seat, shower stops automatically.

To know how is this magic created see the next slide

Working of Magical Rain

An infrared sensor is suitably placed hidden behind the seat of the exhibit.

As and when, a visitor takes a seat, the sensor switches on a relay, which actuates the showers and lights.

The whole system is centrally controlled by an electronic controlling circuit with a timer device.

Elephant throwing Water

- In front of the Energy park you will see an elephant standing near a water body, drinking water by its trunk. It looks calm and friendly.
- But it is an intelligent elephant. It can judge your plan, when you throw water on its trunk .
- It will immediately start playing with you by throwing back water at you.
- Never mind, just enjoy the game with it.

Working of Elephant throwing water …

A water sensor is suitably placed hidden inside the trunk of elephant.

As and when, a visitor throws water to its trunk, the water sensor gets active, which actuates a gear motor and makes the elephant capable to lift its trunk.

A mini pump is also activated to throw water, which is controlled by an electronic controlling circuit with timer device.

POWER GENERATING DRUM

Stand inside the drum and start to walk/ jog.
An LED Panel will light up and music will start to play.
Ever wondered why?
And How?

Learn more…

WORKING OF POWER GENERATING DRUM …

This exhibit is a cylindrical drum made of fiber glass reinforced plastic body with 2 circular rails fitted along the outer surface in such a way that the drum can rotate freely on its axis. When any person tries to jog/walk along the inside periphery of the drum, it rotates automatically to remain in a dynamically stable condition . The drum is connected with a permanent magnet DC dynamo. The dynamo runs a speaker with a music system and an LED panel.

Mechanical energy is converted into electrical energy

ENERGY SLIP

Hear music and have fun with lights as you slide on this normal looking slip….

Working of Energy Slip…

The Energy slip is made of a robust soft endless conveyer belt fitted suitably with metallic wheels. The conveyer belt is inclined with horizontal surface. It moves due to gravitational pull while any rider tries to come down from the top most point of the inclined conveyer during slide. A D.C. dynamo is fitted with upper drum by means of gear assembly. During sliding on the conveyer belt, the upper edge drum drives the dynamo and electricity is generated. The dynamo runs a speaker with a music system and an LED panel.

Solar Energy

- Pushpa Gujral Science City meets 30% of its power demand through Solar power.
- It is the recipient of 2nd Prize at National level from Bureau of Energy Efficiency , Govt. of India in 2014.
- Now, it is trying to shift to maximum solar power usage with the help of Punjab Energy Development Agency

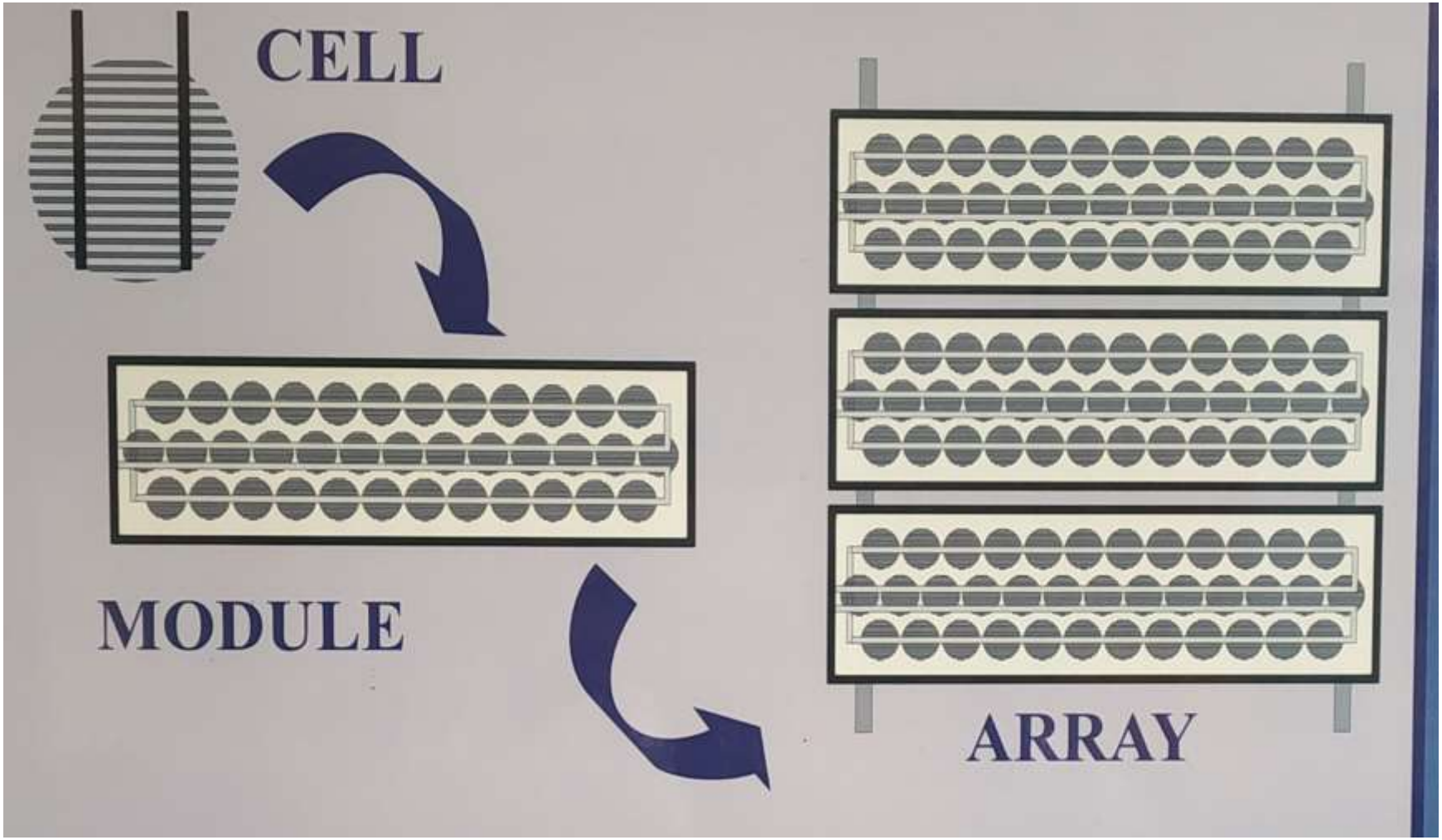
PHOTOVOLTAIC SOLAR ENERGY

- Sunlight is converted to electricity using photovoltaic or solar cells .
- photovoltaic cells are semiconductor devices , usually made of silicon, which contain no liquid , corrosive chemicals or moving parts.
- They produce electricity as long as light shines on them.
- They require a little maintenance
- They do not pollute and operate silently.
- Making photovoltaic energy is the cleanest and safest method of power generation.

PHOTOVOLTAIC TECHNOLOGY

The word "***Photovoltaic***" is a combination of two words- "***Photo***" meaning '***light***' and "***Voltaic***" meaning '***Electricity***'. So, photovoltaic technology, the scientific term used to describe solar energy, involves the generation of electricity from light.

PHOTOVOLTAIC CELLS (SPV)



Semiconductor Photovoltaic Cells (SPV)

- Photovoltaic cells are semiconductor devices , usually made of silicon.
- Semiconductor N-P junction is a semiconductor which is doped as an n-type semiconductor and other side p type semiconductor.
- Photovoltaic (PV)cells converts sunlight into direct current(DC).

Semiconductor Photovoltaic Cells (SPV)…

- **Groups of PV cells are configured into modules and arrays which can be used to power electrical loads.**
- **contain no liquid, corrosive chemicals or moving parts.**
- **They produce electricity as long as light shines on them.**
- **They required little maintenance.**
- **They neither create pollution nor exploit the resources and operate silently.**

Hence photovoltaic energy is the cleanest and safest method of power generation.

Solar Array (Module)

- *A* Solar cell behaves like a low voltage battery whose charge is continuously replenished at a rate proportional to the incident solar radiation.
- Connecting such cells into series-parallel configuration results in photovoltaic module or solar array with high current and voltages

SOLAR WATER HEATER

Solar water heater is a device that uses solar energy to heat water

- Solar energy heats the absorber surface and a heat water flowing through tubes attached to the absorber.
- If a heat – transfer fluid is used , there is a heat exchanger that then heats the water .
- The heated water is transferred to the insulated storage tank either with a pump or without a pump through natural convection .
- A transparent cover is placed above the absorber to reduce heat loses due to radiation .
- The bottom and sides of the absorber are covered with insulation to reduce both types of heat loses.

Advantages of Solar water heater

1. For consumers , they save electrical energy, save interior space.
2. For society at large, they reduce the need to burn fossil fuels for electricity generation.

SOLAR STILL

See a Solar still at PGSC.

It is a device to desalinate impure water like brackish or saline water. It a simple device to get potable /fresh distilled water from impure water, using solar energy as fuel, for its various applications in domestic, and industrial sectors.

Working of Solar Still

- Brackish or saline water is filled in a still basin which is painted black at the bottom .
- Solar radiation received at the surface is absorbed effectively by the blacken surface and heat is transferred to the water in basin .
- Temperature of the water increases which increases rate of evaporation .
- Water vapors formed by evaporation rise upward and condense on the inner surface of the glass coverwhich is relatively cold .
- Condensed water vapors trickle down and are collected in a storage container.

Advantages over other conventional distillation/water purification/de-mineralization system

- Produces pure water
- No prime movers required
- No conventional energy required
- No skilled operator required
- Local manufacturing/repairing
- Low investment
- Can purify highly saline water (even sea water)

BIOGAS

- Biogas is an important renewable energy source. It is the mixture of gases produced by the breakdown of organic matter in the absence of oxygen (anaerobically).
- It primarily consists of methane and carbon dioxide.
- It can be produced from raw materials such as animal waste (gobar), agricultural municipal sewage, etc.
- In India, it is also known as "Gobar Gas".
- Biogas is produced by anaerobic digestion with bacteria, which digest material inside a closed system called as bio-digestor or bioreactor.
- it can be used for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat.[
- Biogas can be compressed, the same way as natural gas

You can see bio-digestors in Science city…

KVIC BIOGAS PLANT

KVIC model was developed in the early sixties by khadi and Village Industries Commission of bio-gas plant.

Working of KVIC Biogas Plant

- This model has an underground cylindrical digester with inlet and outlet connections at the bottom on either side of masonry as the gas holder rests on a wedge type support on top of the digester.
- As the gas begins to accumulate, the drum starts rising in height. The weight of the drum applies pressure on the gas to make it pass through the pipeline to the point of use.
- As the gas flows out, the drum gradually moves down.
- Remains at constant pressure which ensures efficient use of gas.
- KVIC model has two major drawbacks. Firstly, the plant cost is very high, and secondly, the metal gas holder has to be painted regularly for protecting it against corrosion.

DEENBANDHU BIOGAS PLANT

Deenbandhu bio-gas plant model was developed in 1984, by action for Food Production (AFPRO), a voluntary organization based in New Delhi.

DEENBANDHU BIOGAS PLANT…

- Deenbandhu Model has probably been the most significant development in the entire bio gas program of India as it reduced the cost of the plant to almost half that of KVIC model , and brought bio – gas technology within the reach of the poorer sections.
- The world Deenbandhu is meant as the friend of the poor. This plant is designed on the principle that the surface area of biogas plants is reduced (minimized) to reduce their installation cost without sacrificing the efficiency of the plant.
- The cost of reduction has been achieved by minimizing the surface area through joining the segments of two spheres of different digester and the pressure is exerted on the slurry, which is pushed into a displacement chamber.
- Once the gas is drawn out from the outlet the slurry again enters the digester.

Working of Deenbandhu biogas plant

- Initially the digester is filled with a uniformly premixed mixture of dung and water (1:1 ratio) and the digester may be filled in three or four days or more time depending upon the availability of the dung.
- In order to facilitate gas production, addition of 5 to 10% inoculums, taken from a running biogas plant, will hasten the process by three to four days
- The first two or three instalments of gas will not burn because of excessive CO_2.
- When the cattle dung is used as feed stock, the biogas plant is to be filled with a homogenous slurry made from a fresh dung and water in a ratio of 1:1 up to the level of the second step in the outlet chamber (see fig.)

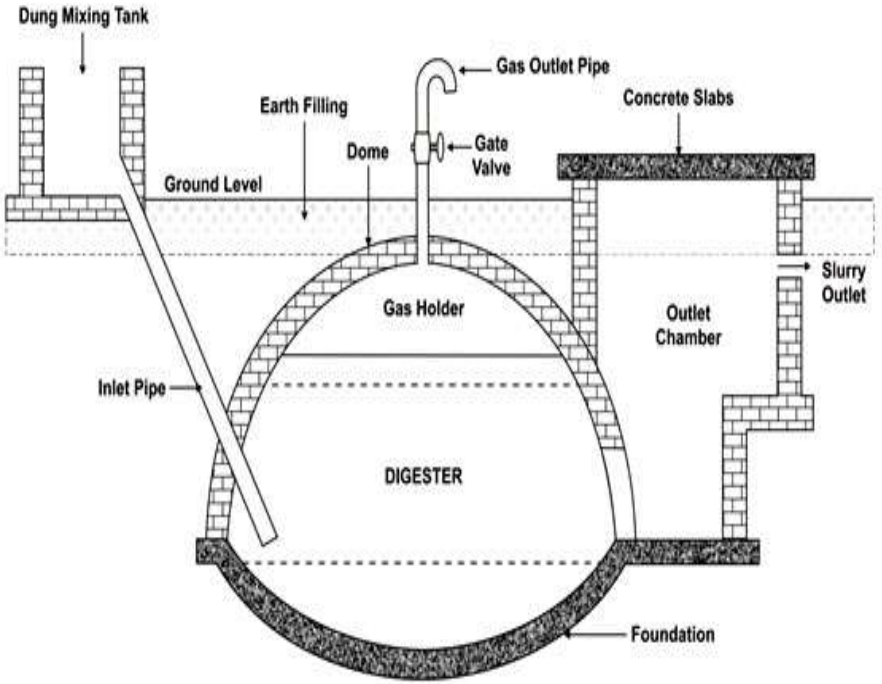


Fig. 6.3 Deenbandhu model biogas plant

Working of Deenbandhu biogas plant…

- As the gas generates and accumulates in the empty portion of dome of the biogas plant, it presses down the slurry of the digester and displaces it into the outlet chamber.
- The slurry level in the digester falls, whereas in the outlet chamber, it starts rising with the formation of gas. This fall and rise continues till the level in the digester reaches the upper end of the outlet opening, and at this stage, the slurry level in the outlet chamber will be at the slurry outlet.
- Any gas produced after this stage will escape through the outlet chamber till the gas is not used.

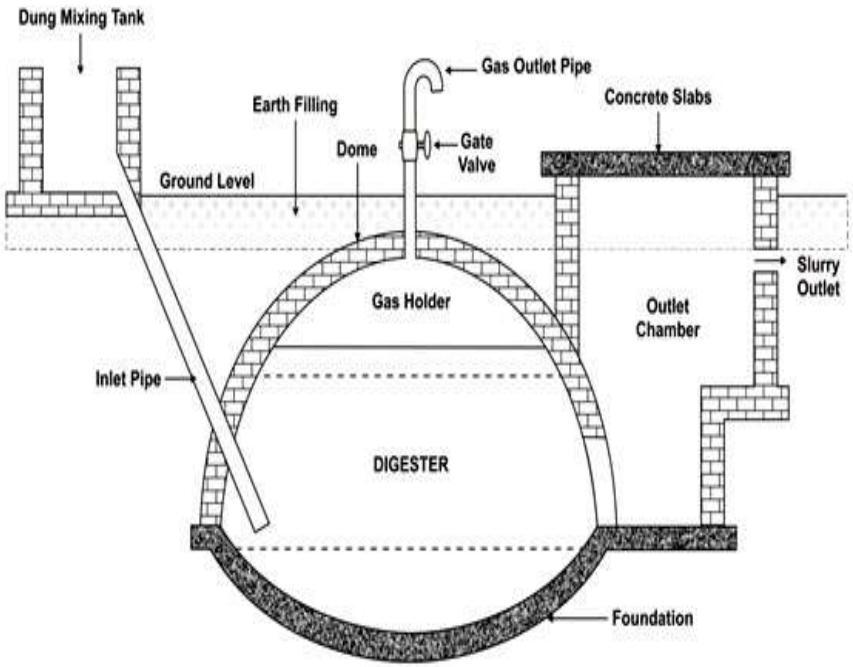


Fig. 6.3 Deenbandhu model biogas plant

Working of Deenbandhu biogas plant…

- When the gas is used, the slurry which was earlier displaced out of digester and stored in the outlet chamber begins to return into the digester. The difference in levels of slurry in digester and the outlet chamber exerts pressure on the gas which makes it flow through the gas outlet pipe to the points of utilization of biogas.

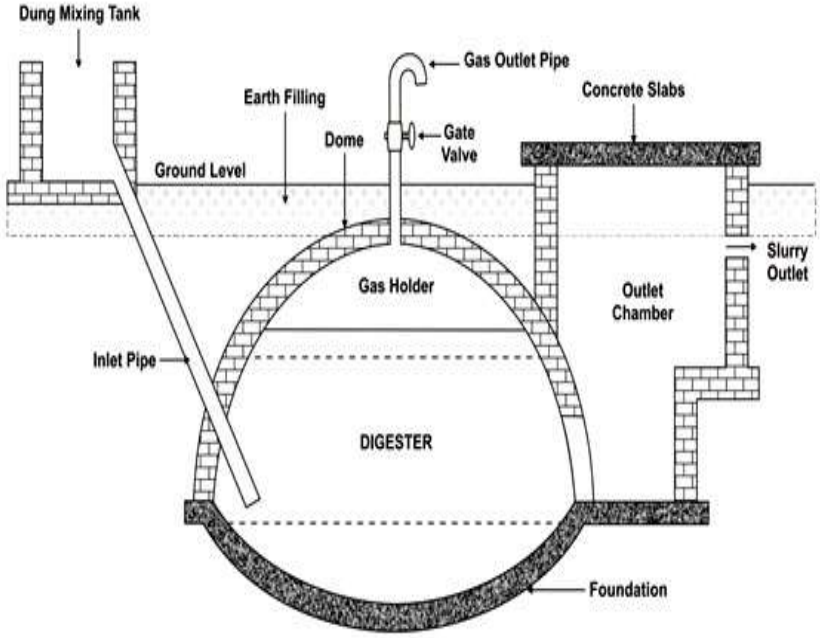


Fig. 6.3 Deenbandhu model biogas plant

Renewable Energy from Water

- Flowing water is a good source of renewable energy.
- The Kinetic energy of water is converted into electrical energy .
- To facilitate this, dams are built.
- A dam is a barrier that stops or restricts the flow of water. Reservoirs created by dams not only suppress floods but also provide water for activities such as production of electricity, irrigation, human consumption, industrial use, aquaculture, etc.
- Punjab has many important Dams

Learn more…

Bhakra Dam Project

Bhakra Dam is a concrete gravity dam on the Sutlej River in Bilaspur, Himachal Pradesh in northern India. The dam forms the Gobind Sagar reservoir.

Bhakra Dam

Silent features

Dam and spillways	
Type of Dam	Concrete gravity
Impounds	Sutlej River
Height	741 ft (226 m)
Length	1,700 ft (520 m)
Width (crest)	30 ft (9.1 m)
Width (base)	625 ft (191 m)
Spillway type	Controlled, overflow

Bhakra Dam

Silent features

Reservoir	
Creates	Gobind Sagar reservoir
Total capacity	9.340 km^3
Surface area	168.035 km^2

Power Station	
Commission date	1945-1946
Turbines	5 x 108 MW, 5 x 157 MW, Francis-type
Installed capacity	1325 MW

Bhakra Dam bridge	
Characteristics	
Total length	1700 feet
Width	30 feet

MODEL OF RANJIT SAGAR DAM (RSD)

The **Ranjit Sagar Dam**, also known as the **Thein Dam**, is part of a hydroelectric project constructed by the Government of Punjab on the Ravi River on the Border of two states of India Jammu and Kashmir and Punjab. 60% of the lake is part of J&K. The project is situated near Pathankot city of the state of Punjab and Kathua city and Basholi tehsil of Kathua district in J&K. The project is the largest hydroelectric dam of the state of Punjab.

Silent features of Ranjit Sagar Dam

Dam

Type : Earth core-cum-gravel shell dam
TOP LEVEL : EL. 540.00 m
Maximum Height of dam :160.00 m
Length at top :617.00 m
Width at top :14.00 m
Normal reservoir level :669.2 m
Normal reservoir level :527.91 m

River diversion Tunnels

Number : 4
Finished Diameter :12 m
TOTAL LENGTH :3448 m
Maximum flow through tunnels : 9800 cumecs

RESERVOIR

CATCHMENT AREA : 6086 sq. km
RESERVOIR AREA : 87sq. km
GROSS STORAGE CAPACITY : 3280 million cum
LIVE STORAGE CAPACITY : 2344 million cum

Silent features of Ranjit Sagar Dam…

Spillway

Spillway is a structure used to provide the controlled release of flows from a dam or lavee in to a down stream area.

CLEAR WATER WAY : 109 m
Crest level : el511.7 m
Maximum outflow : 24637 cumecs
Spillway design flood : 20678 cumecs

Penstocks

Penstock is a channel or pipe for conveying water to a hydroelectric station or water wheel.

No. Of penstock headers : 2
No. Of penstock branches : 4
Dia of each penstock header : 8.5 m
DIA OF EACH PENSTOCK BRANCH : 5.17 m

Power plant

Type of turbines	**: vertical shaft francis**
Maimum net head	**: 121.9 m**
Minimum net head	**: 76.0 m**
No of units	**: 4**
Installed capacity of each unit	**: 150 mw**
Total installed capacity	**: 600 mw**

Barrage Dams

A **barrage** is a low head, diversion dam consisting of number of large gates that can be opened or closed to control the amount of water passing through. This allows the structure to regulate and stabilize river water elevation upstream for use in irrigation and power generation

Example:

- Shahpurkandi Dam

1. Model of BARRAGE PROJECT (Shahpurkandi)

Shapurkandi Dam

- Type of Dam :concrete dam
- No. Of bays : 22
- Length at top : 725.00m
- Max. Pond level: 404.50m
- Min. level: 402.50m
- Top level of the dam: 407.50m
- Size of spillway gates: 12x17m

Silent features of BARRAGE PROJECT (Shahpurkandi)…

Head regulators

Ravi canal

No of spans:3

Clear water way: 9.50 m

Hydel channel

No of spans:7

Clear waterway: 49.00m

Cost of project Rs. 1419 crore (approx).

POWER HOUSES: 2

Capacity Power House-1 : 80 MW

Capacity Power House-2 : 88 MW

Upper Bari Doab Canal (UBDC) Project

A system of canals from Madhopur heads draw water from River Ravi for the purpose of irrigation in the region. On these canals, there has been built small power generation stations generating 90MW of electricity.

Silent Features of UBDC Project

There are six power houses built on Upper Bari Doab Canal (UBDC), each of power generation capacity 15 MW.

WAVE POWER

- Waves are generated by the force of wind blowing over the ocean's surface.
- This exhibit demonstrates how, wave power can be transformed into electricity.
- Here, the visitors can create artificial waves using the handrail flap, suitably fitted in the exhibit.
- With the created waves, the splashed water passes through a tapered channel to a reservoir. When the level of water in reservoir reaches a predefined level, it flows into the sea via turbines, generating electricity. When the level of water in reservoir falls down to the sea level, the turbines stop automatically.

TIDAL POWER

Tides occur due to the gravitational forces of the moon and sun on the ocean water. This exhibit shows how power can be generated using tides.

Working of Tidal Power Model

- By pushing the start button, water level starts to rise in the sea side by creating high tide. When at maximum ebb, the sluice gate opens and allows water flowing into basin side, turbine starts rotating and generates electricity. When low tide comes, sluice gate remains locked. At minimum ebb, sluice gate opens and allows water flow to the sea side. As a result, turbine starts to rotate and generates electricity.
- In this exhibit, artificial tides are created by submersible pump, synchronised by sluice gate and turbine through an electronic control system.

WIND MILL (General information)

- A **windmill** is a structure used to harness the power of the **wind** for purposes like grinding grain, pumping water and generating electricity.
- The oblique blades of the wind mill derives energy from the force of wind.
- The shaft of wind mill can be connected to a pump to extract water or to a grinder to grind the grains.

Wind mill

WIND TURBINE GENERATOR
(General information)

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When the **windmill** is used for purpose of generating electricity, it is known as a wind turbine generator.

A permanent magnet dynamo is fixed with the shaft of the wind mill to generate the electricity

WIND MILL & TURBINE GENERATOR

(Additional information)

- This device derives energy from the force of wind on oblique blade or sails that radiate from a shaft.
- When the shaft is connected to a load, such as pump, the device is typically called a windmill.
- When it is used to generate electricity, it is known as a wind turbine generator.
- Wind turbine contributes very little pollution and few greenhouse gases to the environment. It is a valuable alternative to fossil fuels.

Wind mill

Wind turbine generator

GEOTHERMAL ENERGY

(General information)

- Geothermal energy comes from the heat within the earth.
- The word “geothermal” comes from the Greek words geo, meaning “earth” and thermal , meaning “heat.”

GEOTHERMAL ENERGY

Additional information

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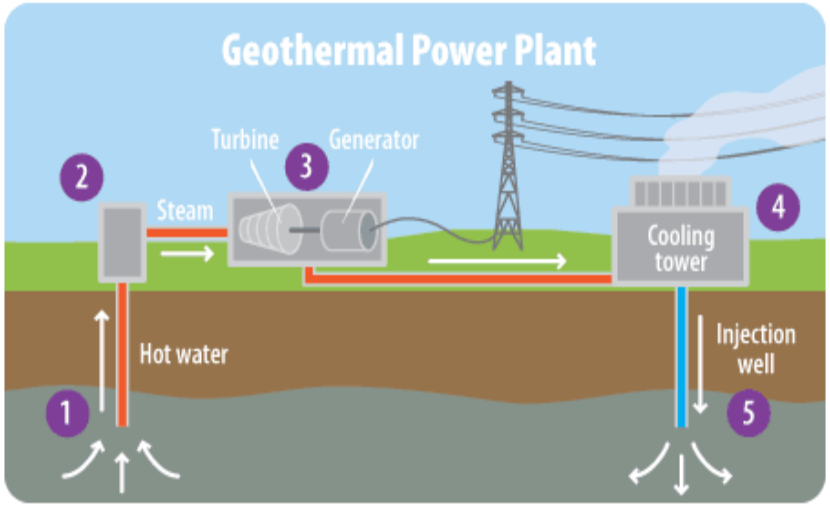
GEOTHERMAL POWER PLANT

- Rising hot water and steam is trapped form a geothermal reservoir.
- Natural steam from the production wells power the turbine generator. This steam is then used to rotate the turbine blades inside a geothermal turbine generator.
- In the next step, the steam is condensed in the cooling tower and pumped down in injection well to sustain production.
- The force of steam is used to spin the turbine blades which spin the generator, producing electricity.



Geothermal power plants in India

Puga valley, Ladakh

The Puga valley in the Ladakh region has the most promising geothermal field . An experimental 1-kW generator is already in operation in this area.

Geothermal power plants in India

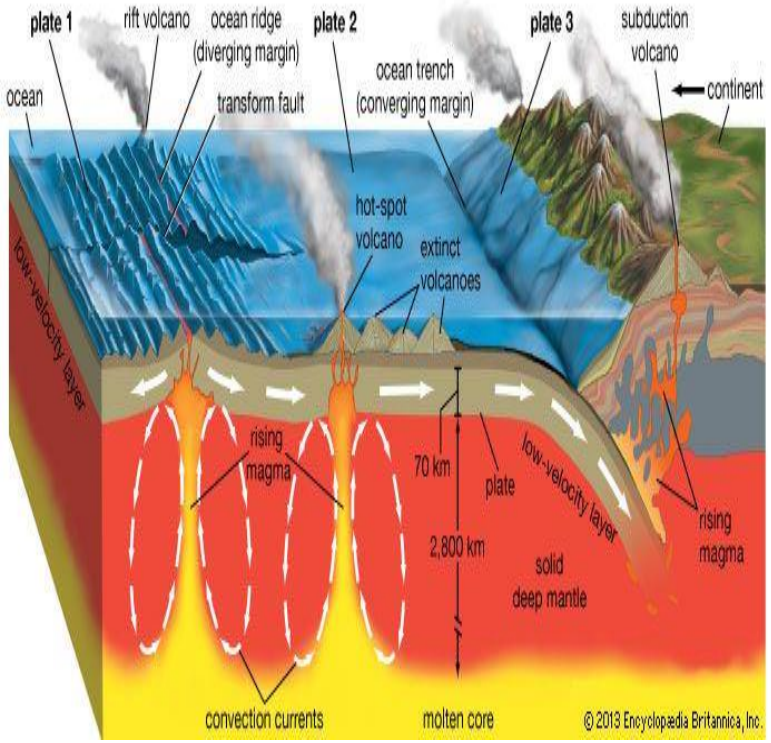
Tattapani geothermal Plant

Tattapani geothermal power plant is India's first geothermal plant in Sarguja district, Chhattisgarh.

Chhattisgarh Renewable Energy Development Agency (CREDA) and National Thermal Power Corp. (NTPC) had signed a MOU in this connection.

FORMATION OF GEOTHERMAL RESERVOIR…

- Reservoirs on earth has been formed as heat flows outward from Earth's interior. The deeper you go, the hotter it gets . It is the crust which insulates and saves us from the direct heat of Earth's interior.
- Earth's crust is broken into huge plates that moves apart or push together. Convection of semi-molten rock in the upper mantle helps drive plate tectonics.



FORMATION OF GEOTHERMAL RESERVOIR…

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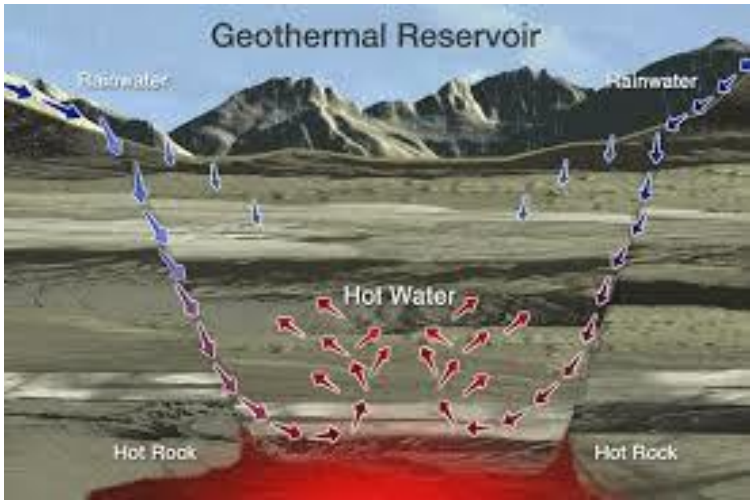
- Thinned or fractured crust allows magma to rise to the surface as lava. Most magma doesn't reach the surface but heats large regions of underground rock.

FORMATION OF GEOTHERMAL RESERVOIR…

- Rising hot water and steam is trapped in permeable and porous rocks under a layer of impermeable rock, to form a geothermal reservoir.



Thank you