TOPIC

Power Point Presentation on

"Existing facilities and future opportunities for developing renewable energy sources in India"

What is Renewable Energy?

- Energy from a source that is not depleted when used, such as wind or solar power.
- Any energy resource that is naturally regenerated over a short time scale and derived directly from the sun (such as thermal, photochemical, and photoelectric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy).

DIFFERENCE BETWEEN RENEWABLE AND NON-RENEWABLE SOURCE OF ENERGY

RENEWABLE SOURCE	NON-RENEWABLE SOURCE
➢ Definition : Renewable energy can be generated continuously practically without decay of source.	• Definition : non-renewable can't be generated continuously without decay of source.
➢ Responsible for 3-4% of carbon dioxide in environment.	• Responsible for 91-94% of carbon dioxide in environment.
➢ Not a reason behind "global warming".	• Main reason behind "global warming".
➢ Example : biomass, hydro power, wind energy, solar energy,etc.	• Example : petroleum products,coal,uranium,etc.

Renewable Energy Sources


I Used to love the darkness
but the sun is my best friend
As soon as I embraced him
He put my misery to an end
SOLAR POWER

Solar Power

Solar power is the conversion of sunlight into electricity, either directly using Photovoltaic (PV), or indirectly using concentrated solar power. In a sunny climate, you can get enough power to run a 100W light bulb from just one square meter of solar panel.

National CSP capacity in India 225 MWp (source: REN21 Global Status Report sep. 2015)

2011 Census

- one in three houses in India has no electricity and many villages and towns don’t get an uninterrupted electricity supply.

Growth of Solar Power in India (in MW)

- Rajasthan – 1294.60
- Tamilnadu – 1267.41
- Gujrat - 1123.36

{as on 31st July 2016}

(Source: "State wise installed solar power capacity report" Ministry of New and Renewable Energy Govt. of India)

And 66% growth in Solar Roof Top Market.
Recently India added 240 MW of Rooftop Solar Capacity against 145MW in Nov.2014 to Oct. 2015

Existing Solar Plants in India

- Kamuthi Solar Power Plant 360MW Tamil Nadu
- Titan Energy plant 3 MW, kolar district Karnatka
- Titan Energy, 2 MW plant ,Jamuria, West Bengal
- Moser Baer ,Thin Film 1 MW ,Maharashtra
- Lanco , 5 MW ,Gujarat.
- North Delhi Power Ltd (Tata Power) 1 MW , Delhi.
- Reliance ,1 MW ,Thyagaraj stadium Plant,Delhi
- Azure Power 2 MW Awan, Punjab India.

Upcoming Solar Power Projects in India 2016 - 017

- 5 MW Solar Power Project Coming up in South Tamil Nadu
- 14 MW Solar Power Project Coming up in Davangere , Karnataka
- Rs.1239.1 million Northern Region System Strengthening Scheme Project in mulitple States
- Rs.1362 million Power Transmission Project in Gujarat

National Bank of Agriculture and Rural Devlopment (NABARD)

- Has sanctioned a loan of 204.67 Crore for Haryana under Rural infrastructure Development program

Solar Water Heating

- Heat from the Sun is used to heat water in glass panels on your roof.
- Bangalore is the first city in the country to put in place an incentive mechanism by providing a rebate of ₹50 on monthly electricity bills for residents using roof-top thermal systems. These systems are now mandatory for all new structures. (Source: “the solar water rebate” The Hindu 26 nov.2009)

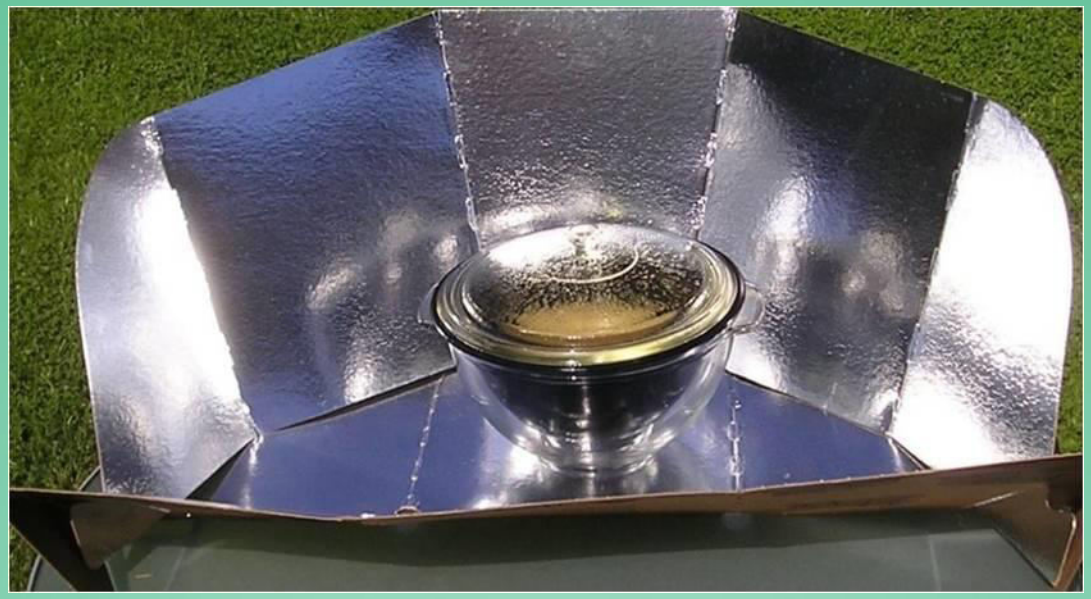
Solar Furnaces

- Use a huge array of mirrors to concentrate the Sun's energy into a small space and produce very high temperatures.

Solar Energy For Cooking

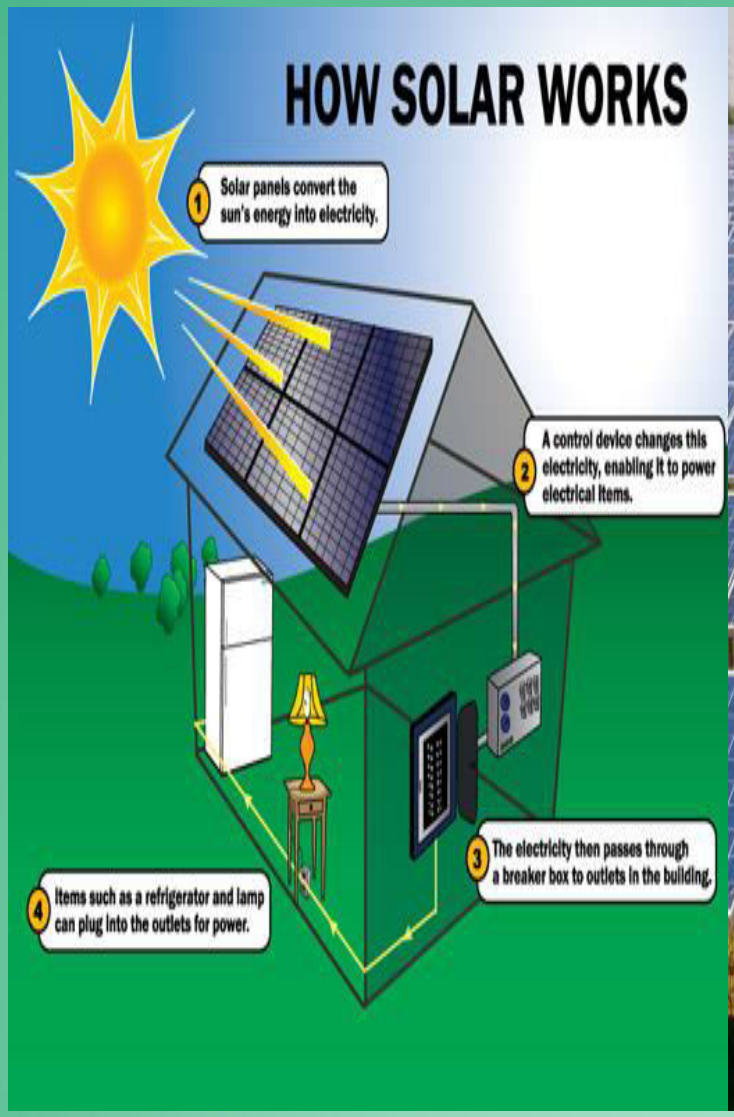
- Cooking with the use of solar energy is much easier than you think. We call it thinking outside the box, or in this case, cooking within a box. Imagine cooking inside a solar oven instead of your conventional one at home. Building one of these is a recipe for successful cooking on sunny days! With a box, pan, aluminum foil, a cooking bag, duct tape (man's best friend), Styrofoam insulation, and a thermometer, you'll be cooking in no time at all.

How Solar Work For Cooking



Power Your Home With Solar Energy

- The system needed isn't that complex when you examine the devices needed. Simply add solar panels to collect sunlight and convert it into electricity. DC power (direct current) is then sent to an inverter, which converts DC power into Ac power, which now runs your home. Through the use of transfer switches and other safety devices


HOW SOLAR WORKS
1 Solar panels convert the sun's energy into electricity.
2 A control device changes this electricity, enabling it to power electrical items.
3 The electricity then passes through a breaker box to outlets in the building.
4 Items such as a refrigerator and lamp can plug into the outlets for power.

Other Uses Of Solar Energy

- **Indoor Lighting**
- **Outdoor Lighting**
- **Battery Charging**
- **Power Pumps With Solar Energy**
- **Solar Energy Can Heat Our Home**
- **Mobile charging**

Products

Advantages to solar power

- Solar energy is free - it needs no fuel and produces no waste or pollution.
- In sunny countries, solar power can be used where there is no easy way to get electricity to a remote place.
- Handy for low-power uses such as solar powered garden lights and battery chargers

Disadvantages to Solar Power

- Doesn't work at night.
- Very expensive to build solar power stations.
  Solar cells cost a great deal compared to the amount of electricity they'll produce in their lifetime.
- Can be unreliable unless you're in a very sunny climate.

WIND ENERGY

Wind power

- We have used the wind as an **Energy** source for a long time.

The **Babylonians** and **Chinese** were using wind power to pump water for irrigating crops 4,000 year ago.

- Wind power was used in the middle ages, in Europe to grind grain and lifting water , which is where the term windmills comes from.

A Wind Turbine

Pitch

Rotor

Blades

Generator

Tower

How Wind Power Works

- **WIND TURBINES** convert the kinetic energy in the **WIND** into mechanical energy. And generator can convert the mechanical power into electricity.
- The energy in the wind turn two or three propeller like blades a rotor. Rotor is connected to the main shaft which spin a generator to create an electricity.
- Wind turbines are mounted on tower about the height of 30meter to captured the most energy.

Advantages of Wind power

- Wind is free, wind farms need no fuel.
- Produces no waste or greenhouse gases.
- The land beneath can usually still be used for farming.
- Wind farms can be tourist attractions.
- A good method of supplying energy to remote areas.

Disadvantages of Wind Power

- The wind is not always predictable some days have no wind.
- Suitable areas for wind farms are often near the coast, where land is expensive.
- Can kill birds - migrating flocks tend to like strong winds. Splat!
- Can affect television reception if you live nearby.
- Noisy. A wind generator makes a constant, low, "swooshing" noise day and night.

Wind Energy Programme in India

Growth factor for wind

- Technology development and a strong domestic manufacturing base.
- Conducive policy frame for investment.
- Quality assurance:

National institute for wind energy chennai

- RLMM committee:
  Revise list of manufacturers & model committee
- Approves model for wind energy

Wind policy in states

Wind potential states are providing promotional tariff for wind power projects

State	Tariff per kWh
Andhra Pradesh & Telangana	4.84
Gujarat	4.15
Karnataka	4.50
Kerala	4.77
Madhya Pradesh	4.78
Maharashtra	3.82-5.56
Rajasthan	5.76 & 6.04
Tamil Nadu	4.16

States are also providing concessional wheeling, banking, Electricity Duty and Cross Subsidy Surcharges

Largest wind farm of the world

INDIA

Jaisalmer

WORLD

London Array

Is Wind Power Renewable?

- **Wind power <u>is</u> renewable.**

- **Winds will keep on blowing, it makes sense to use them.**

"If there is a magic on this planet, It is Contained in Water"
(Loren Eisley, Anthropologist)

- HYDROELECTRICITY

Hydroelectricity

- A dam is built to trap water, usually in a valley where there is an existing lake.
- Water is allowed to flow through tunnels in the dam, to turn turbines and thus drive generators.
- Hydro-electricity provides 20% of the world's power

Advantages of Hydroelectricity

- Once the dam is built, the energy is virtually free.
- No waste or pollution produced.
- Much more reliable than wind, solar or wave power.
- Water can be stored above the dam ready to cope with peaks in demand.
- Hydro-electric power stations can increase to full power very quickly, unlike other power stations.
- Electricity can be generated constantly.

Disadvantages to Hydro-electricity

The dams are very expensive to build.

- Building a large dam will flood a very large area upstream, causing problems for animals that used to live there.
- Finding a suitable site can be difficult - the impact on residents and the environment may be unacceptable.
- Water quality and quantity downstream can be affected, which can have an impact on plant life.

Hydro Electric Power Plants in India

Plant	River	State	Capacity
Koyna Hydro Electric Power Plant	Koyna	Maharashtra	1,960 MW
Srisailam Hydro Electric Power Plant	Krishna	Andhra Pradesh	1,670 MW
Nathpa Jhakri Hydro Electric Power Plant	Satluj River	Himachal Pradesh	1,500 MW
Sardar Sarovar Hydro Electric Power Plant	Narmada	Gujarat	1450 MW
Bhakra-Nangal Hydro Electric Power Plant	Sutlej	Himachal Pradesh	1325 MW

- TIDAL POWER

Tidal Power

- Tidal power works rather like a hydro-electric scheme, except that the dam is **much** bigger.
- A huge dam (called a "barrage") is built across a river estuary. When the tide goes in and out, the water flows through tunnels in the dam.
- The ebb and flow of the tides can be used to turn a turbine, or it can be used to push air through a pipe, which then turns a turbine. Large lock gates, like the ones used on canals, allow ships to pass.
- Only around 20 sites in the world have been identified as possible tidal power stations.

Advantages to Tidal Power

- Once you've built it, tidal power is free.
- It produces no greenhouse gases or other waste.
- It needs no fuel.
- It produces electricity reliably.
- Not expensive to maintain.
- Tides are totally predictable.

Disadvantages to Tidal Power

A barrage across an estuary is very expensive to build, and affects a very wide area - the environment is changed for many miles upstream and downstream. Many birds rely on the tide uncovering the mud flats so that they can feed. there are few suitable sites for tidal barrages.

Only provides power for around 10 hours each day, when the tide is actually moving in or out.

- BIOMASS ENERGY

Biomass Energy

- Biomass is fuel that is developed from organic materials, a renewable and sustainable source of energy used to create electricity or other forms of power.

1. Scrap lumber
2. Forest debris
3. Certain crops
4. Manure
5. Some types of waste residues.

How Biomass Works

- Plant and animal waste is used t

produce fuels such as methanol, natural gas, and oil. We can use rubbish, animal manure, woodchip seaweed, corn stalks and other wastes.

Sugar cane is harvested and taken to a mill, where it is crushed to extract the juice. The juice is used to make sugar, whilst the left-over pulp, called "bagasse" can be burned in a power station.

Cont.

Other solid wastes, can be burned to provide heat, or used to make steam for a power station.

Burn fuel > heat water to make steam>steam turns turbine > turbine turns generator>electrical power sent around the country

Advantages to Biomass

- It makes sense to use waste materials where we can.
- The fuel tends to be cheap.
- Less demand on the Earth's resources.

Disadvantages to Using Biomass

- Collecting the waste in sufficient quantities can be difficult.
- We burn the fuel, so it makes greenhouse gases.
- Some waste materials are not available all year round.

Is It Renewable?

- **Biomass <u>is</u> renewable**

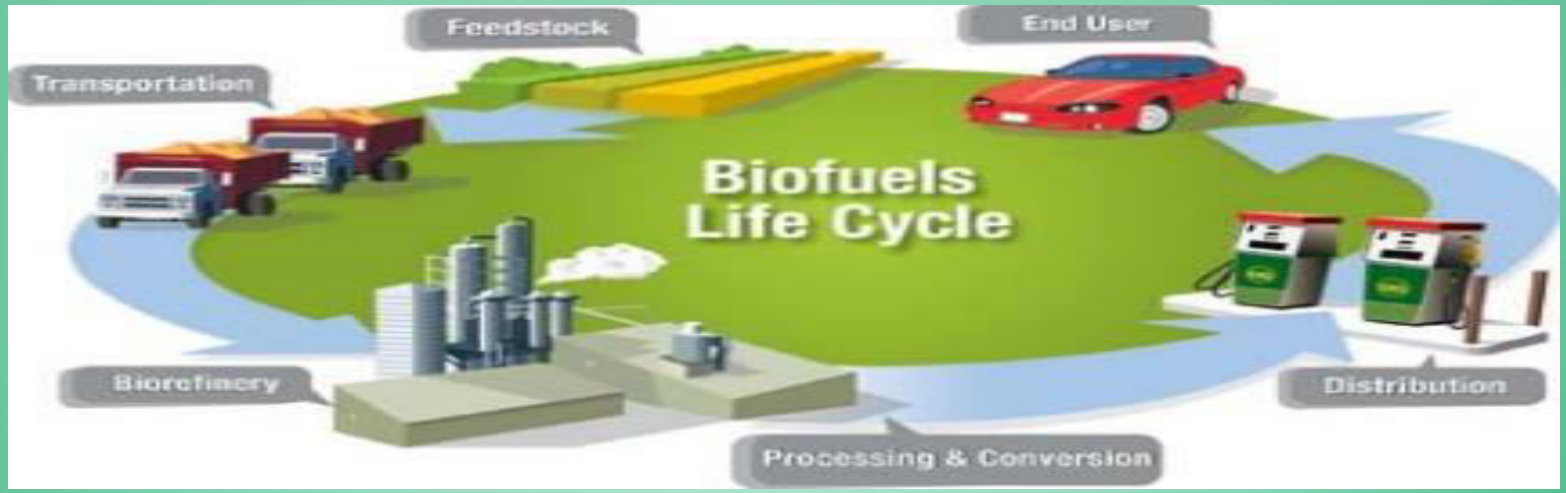
•We will always make waste products.
We can always plant & grow more sugar cane and more trees, so those are renewable too.

Biofuels

- Biofuels are produced from living organisms or from metabolic by-products (organic or food waste products).
- Biofuel may be derived from agricultural crops, including conventional food plants or from special energy crops. Biofuels may also be derived from forestry, agricultural or fishery products or municipal wastes, as well as from agro-industry, food industry and food service by-products and wastes.
- **Example :- Swamp Gas Power, Alcohol Power, Poo Power, bio diesel.**

Use Of Biofuel

- **Cars and Trucks**
- **Aircraft**
- **Off-Road Equipment**
- **Small Engines**

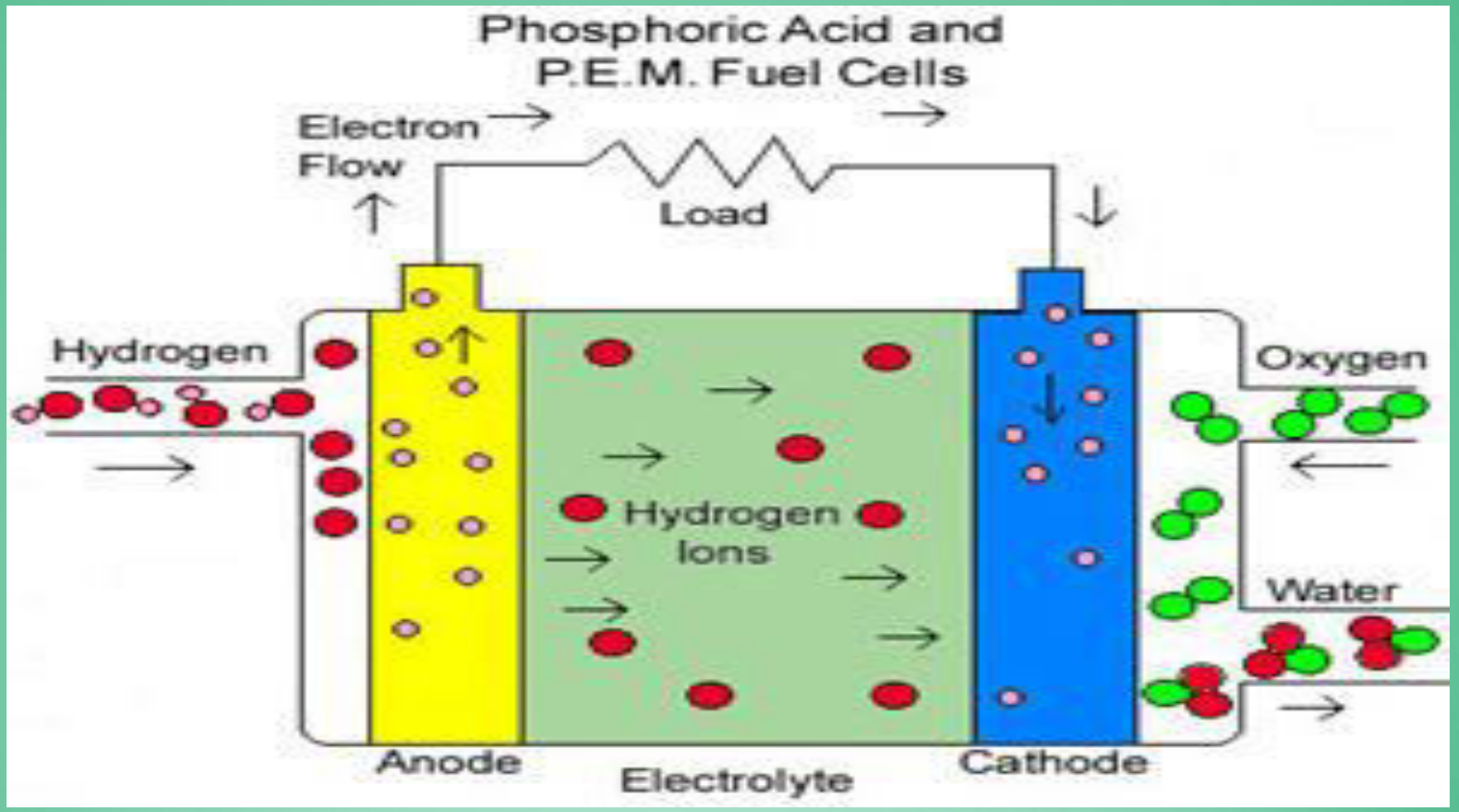


ADVANTAGES OF BIOFUELS

- **Cost:** Biofuels have the potential to be significantly less expensive than gasoline and other fossil fuels.
- **Source material:** Whereas oil is a limited resource that comes from specific materials, biofuels can be manufactured from a wide range of materials including crop waste, manure, and other byproducts. This makes it an efficient step in recycling.
- **Renewability:** It takes a very long time for fossil fuels to be produced, but biofuels are much more easily renewable as new crops are grown and waste material is collected.
- **Security:** Biofuels can be produced locally, which decreases the nation's dependence upon foreign energy
- **Economic stimulation:** Because biofuels are produced locally, biofuel manufacturing plants can employ hundreds or thousands of workers, creating new jobs in rural areas.
- **Lower carbon emissions:** When biofuels are burned, they produce significantly less carbon output and fewer toxins, making them a safer alternative to preserve atmospheric quality and lower air pollution.

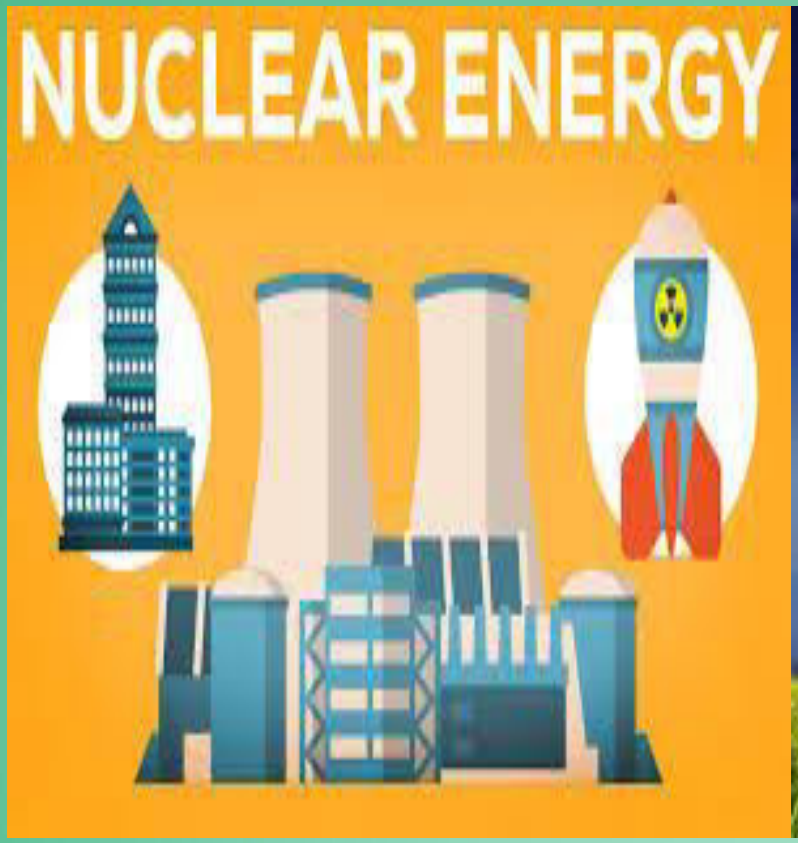
Fuel Cell

- A fuel cell is a device which takes stored chemical energy and converts it to electrical energy directly.



- NUCLEAR ENERGY

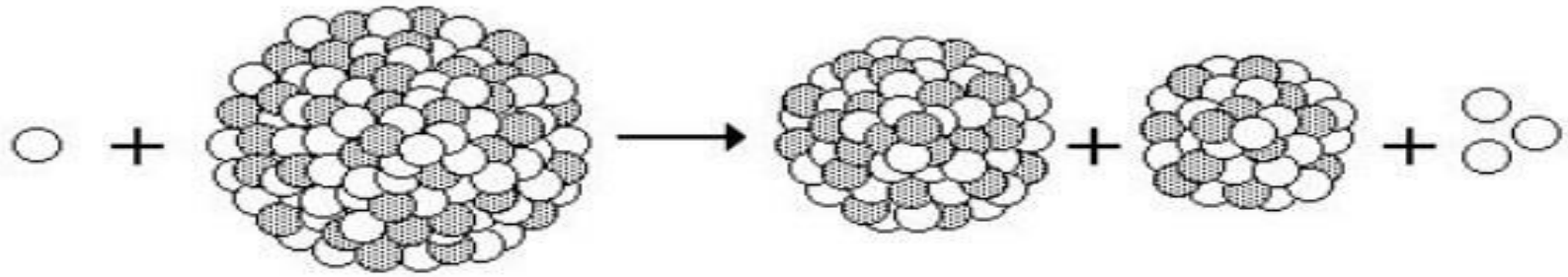
Nuclear Energy



Nuclear Fission

- Nuclear power is generated using Uranium, which is a metal mined in various parts of the world.
- Nuclear power produces around 11% of the world's energy needs, and produces huge amounts of energy from small amounts of fuel, without the pollution that you'd get from burning fossil fuels.

Nuclear Fission



$$ {}^{1}_{0}\mathbf{n} + {}^{235}_{92}\mathbf{U} \longrightarrow {}^{141}_{56}\mathbf{Ba} + {}^{92}_{36}\mathbf{Kr} + 3\,{}^{1}_{0}\mathbf{n} + \mathbf{Energy} $$

value

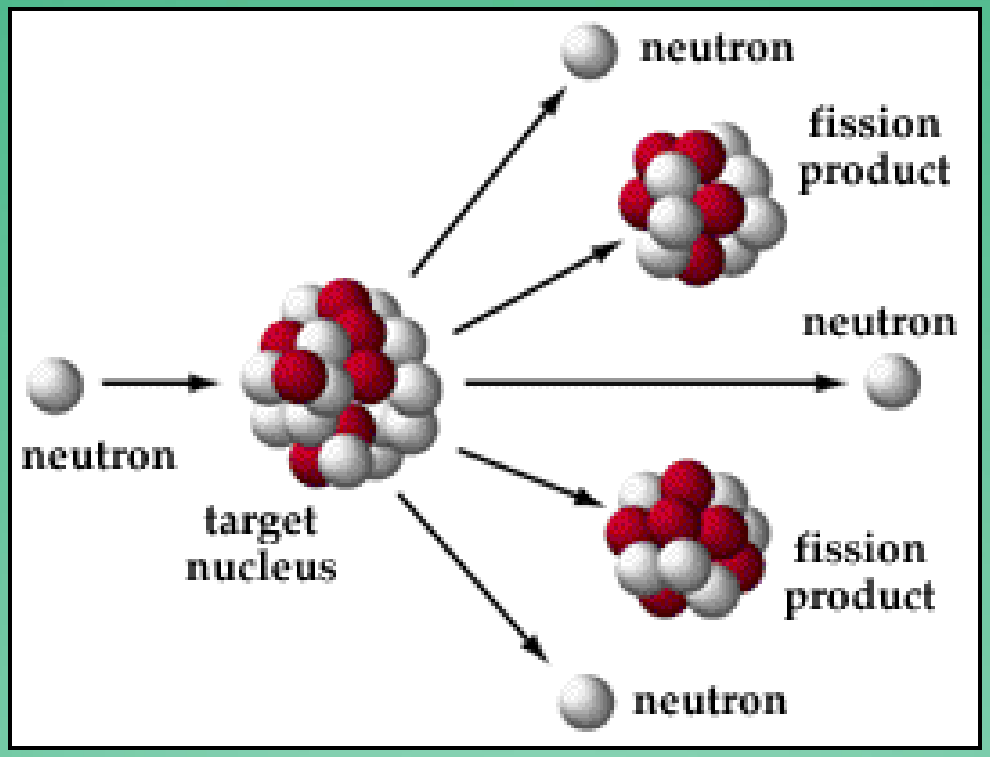
energy | mass | speed of light

$$ E = mc^2 $$

J | kg | 299,792,458 m/s

units

$c^2 = 89{,}875{,}517{,}873{,}681{,}800\ m^2/s^2$



- The reactor uses Uranium rods as fuel, and the heat is generated by **nuclear fission**. Neutrons smash into the nucleus of the uranium atoms, which split roughly in half and release energy in the form of heat.

How Nuclear Power Works

- Nuclear fission makes heat>heated water makes steam>steam turns turbines>turbines turn generators>electrical power is sent around the country

Nuclear Fusion

- Nuclear fusion is an atomic reaction in which multiple atom s combine to create a single, more massive atom. The resulting atom has a slightly smaller mass than the sum of the masses of the original atoms. The difference in mass is released in the form of energy during the reaction

What Are The Challenges ?

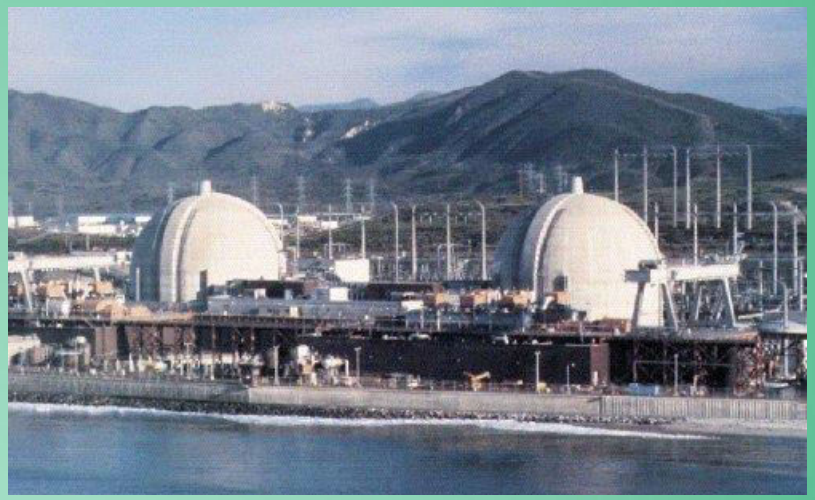
- For fusion to occur, reactor temperatures would have to be on the order of 200 million degrees Celsius
- No material on earth can withstand 200 million degrees without melting
- Two basic strategies:

  1) Magnetic Confinement: Confine the plasma with magnetic fields so that the plasma will not touch the containment walls

  2) Inertial Confinement: Supply large amounts of energy very quickly (i.e. shoot with lasers) so that the fuel is burned before it has time to expand and touch the walls

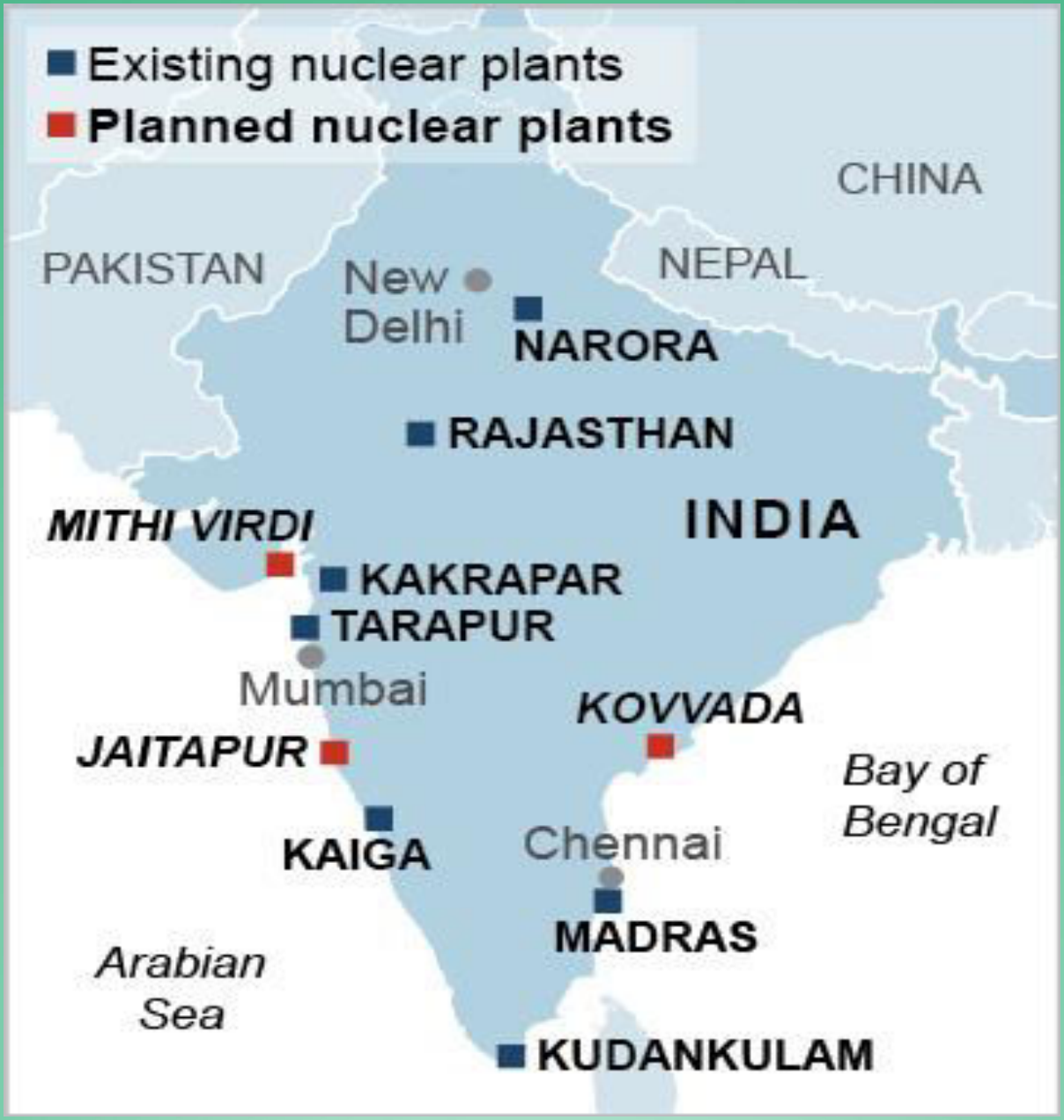
Advantages to Using Nuclear Power

- Nuclear power costs about the same as coal, so it's not expensive to make.
- Does not produce smoke or carbon dioxide, so it does not contribute to the greenhouse effect.
- Produces huge amounts of energy from small amounts of fuel.
- Produces small amounts of waste.
- Nuclear power is reliable.



Disadvantages of Nuclear Power

- Although not much waste is produced, it is very, very dangerous.
  It must be sealed up and buried for many years to allow the radioactivity to die away.


Existing nuclear plants
Planned nuclear plants
CHINA
PAKISTAN
NEPAL
New Delhi
NARORA
RAJASTHAN
INDIA
MITHI VIRDI
KAKRAPAR
TARAPUR
Mumbai
KOVVADA
JAITAPUR
Bay of Bengal
KAIGA
Chennai
MADRAS
Arabian Sea
KUDANKULAM

IS NUCLEAR ENERGY IS RENEWABLE ?

- GEO- THERMAL POWER

Geothermal Power

Hot rocks underground heat water to produce steam.

We drill holes down to the hot region, steam comes up, is purified and used to drive turbines, which drive electric generators.

- There may be natural "groundwater" in the hot rocks anyway, or we may need to drill more holes and pump water down to them.

Direct Uses Of Geothermal Energy

- space heating
- air conditioning
- industrial processes
- drying
- Greenhouses
- Aquaculture
- hot water
- resorts and pools
- melting snow

Advantages to Geothermal Power

- Geothermal energy does not produce any pollution, and does not contribute to the greenhouse effect.
- The power stations do not take up much room, so there is not much impact on the environment.
- No fuel is needed.
- Once you've built a geothermal power station, the energy is almost free.
  It may need a little energy to run a pump, but this can be taken from the energy being generated.

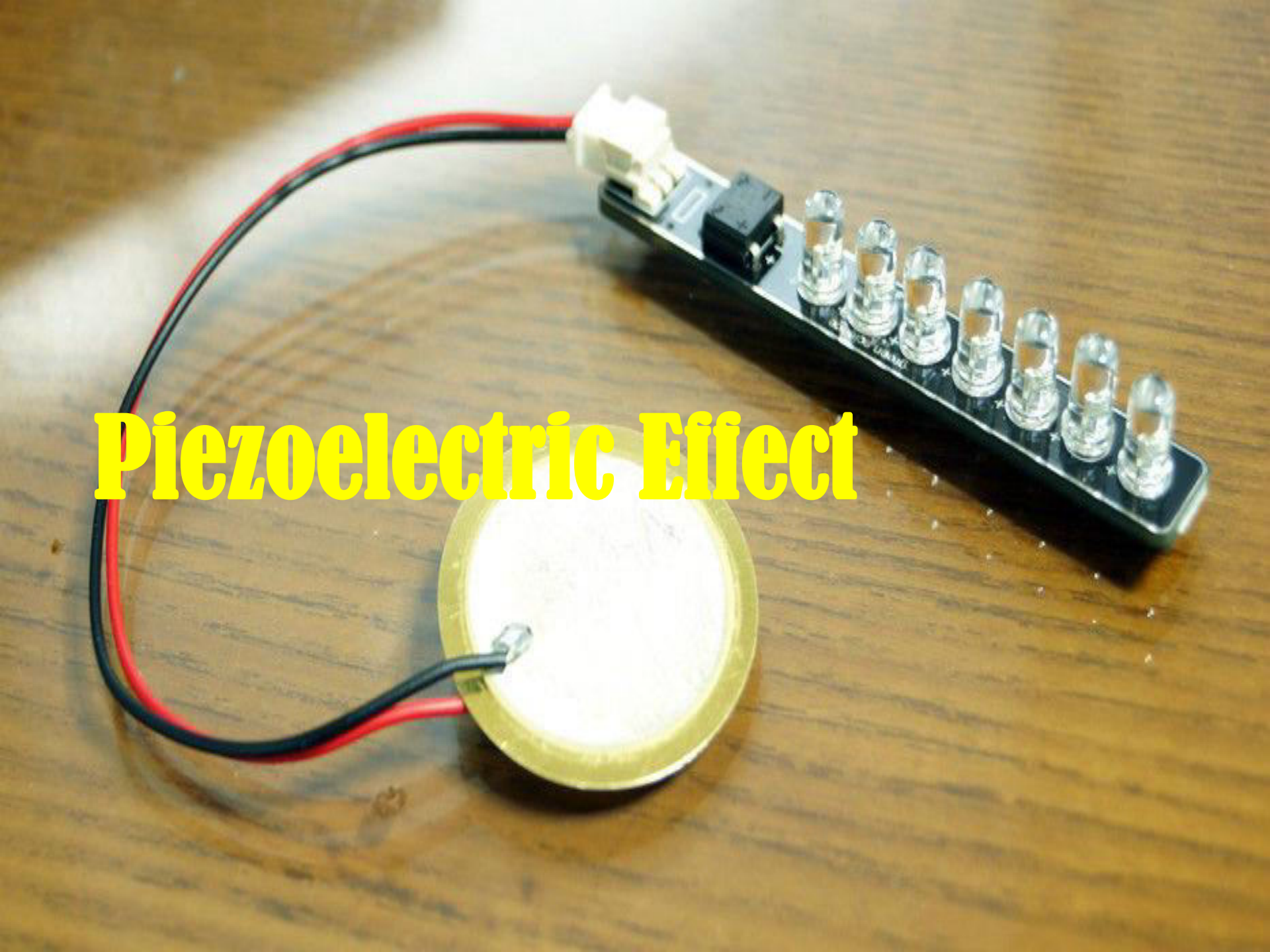
Disadvantages to Geothermal Power

- The big problem is that there are not many places where you can build a geothermal power station. You need hot rocks of a suitable type, at a depth where we can drill down to them.
  The type of rock above is also important, it must be of a type that we can easily drill through.
- Sometimes a geothermal site may "run out of steam", perhaps for decades.
- Hazardous gases and minerals may come up from underground, and can be difficult to safely dispose of.

Is it Renewable?

- **Geothermal energy <u>is</u> renewable.**

  •The energy keeps on coming, as long as we don't pump too much cold water down and cool the rocks too much.


Piezoelectric Effect

CONTENTS

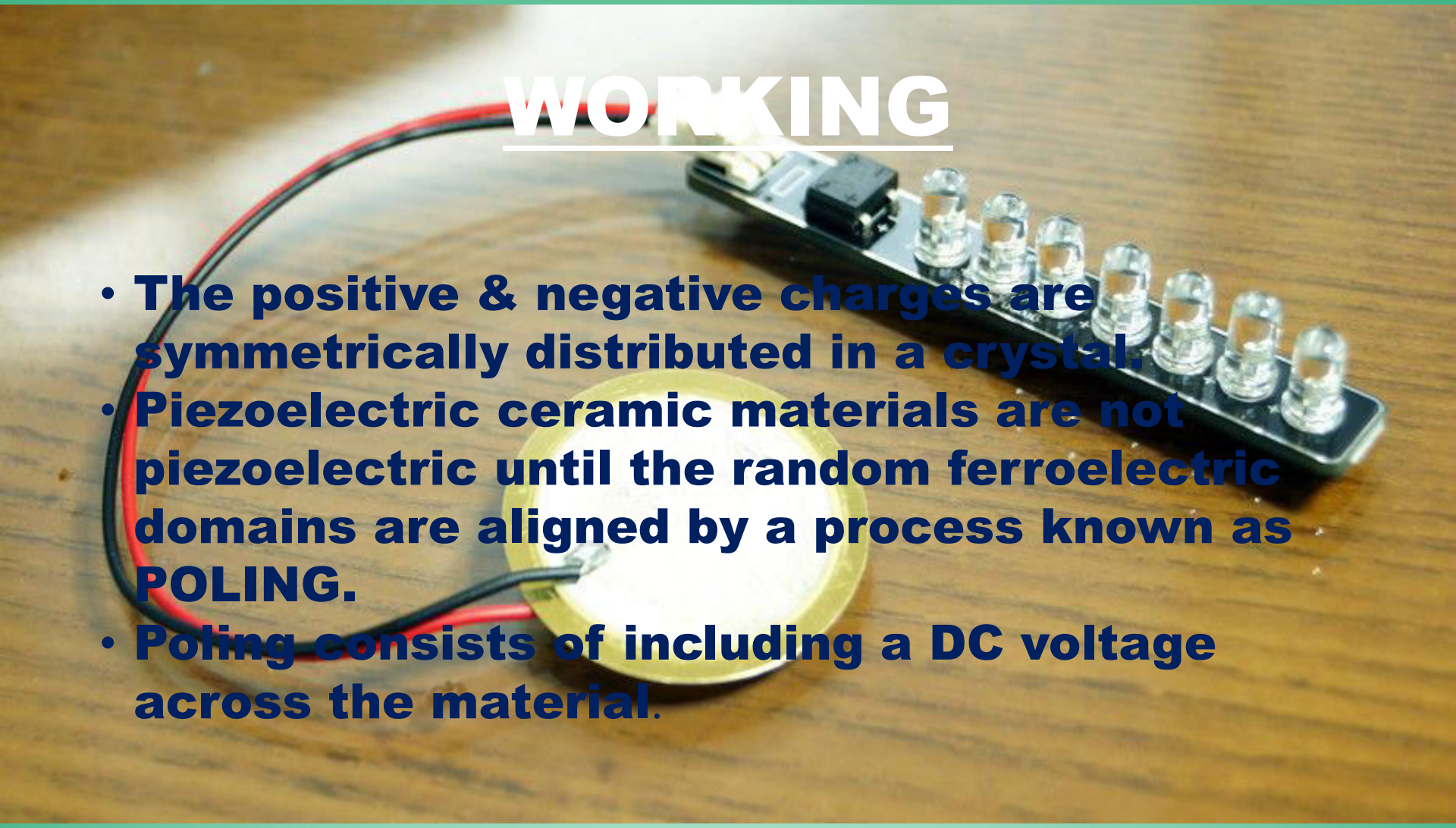
INTRODUCTION

- Piezoelectricity was discovered by Curie brothers in 1880.
- It is the generation of electric field from applied pressure.
- It is observed in crystalline material with no inversion symmetry.
- The materials exhibiting the direct piezoelectric also exhibit the reverse piezoelectric effect.
- Conversely, when an electric field is applied to one of the faces of the crystal it undergoes mechanical distortion.

MATERIALS

NATURAL	SYNTHETIC
QUARTZ	LEAD ZIRCONATE TITANATE(PZT)
ROCHELLS	ZINC OXIDE (ZnO)
TOPAZ	BARIUM TITANATE (BaTiO3)
SURCOSE	GALLIUM ORTHO9PHOSPHATE (GaPO4)
TENDON	POTASSIUM NIOBATE (KNbO3)
SILK	LEAD TITANATE (LiTaO3)
ENAMEL	LITHIUM TANTALATE (LiTaO3)
DENTIN	LANGASITE (La3Ga5SiO4)
DNA	SODIUM TUNGSTATE (Na2WO3)

WORKING



- The positive & negative charges are symmetrically distributed in a crystal.
- Piezoelectric ceramic materials are not piezoelectric until the random ferroelectric domains are aligned by a process known as POLING.
- Poling consists of including a DC voltage across the material.

CONTD.

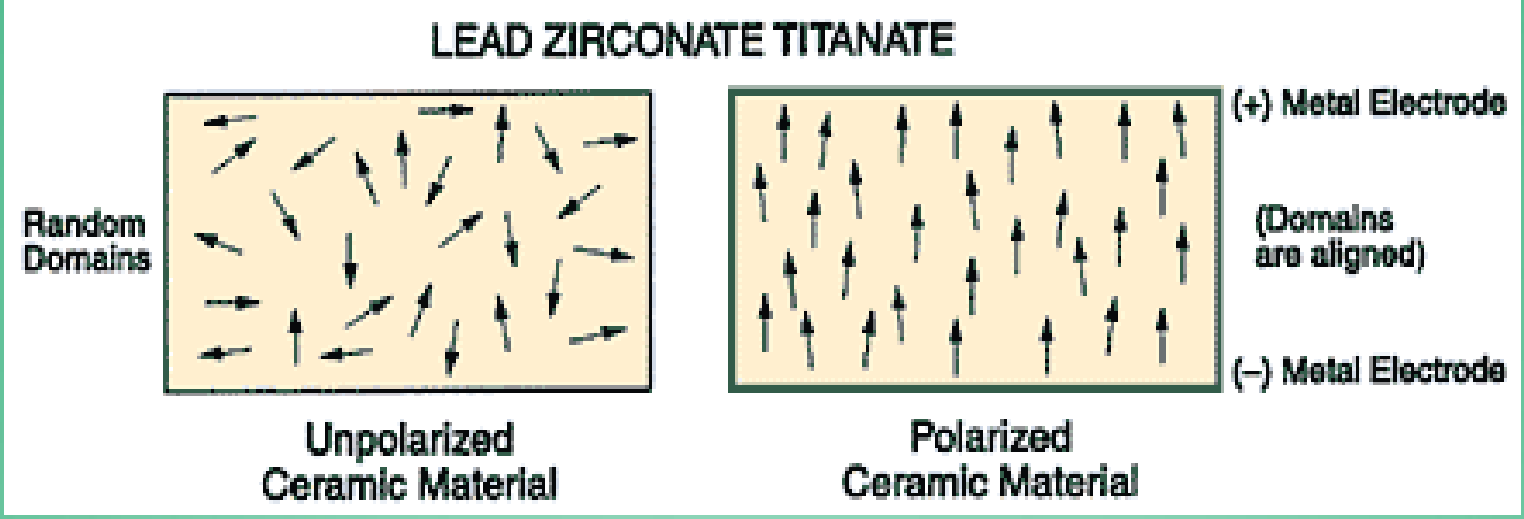
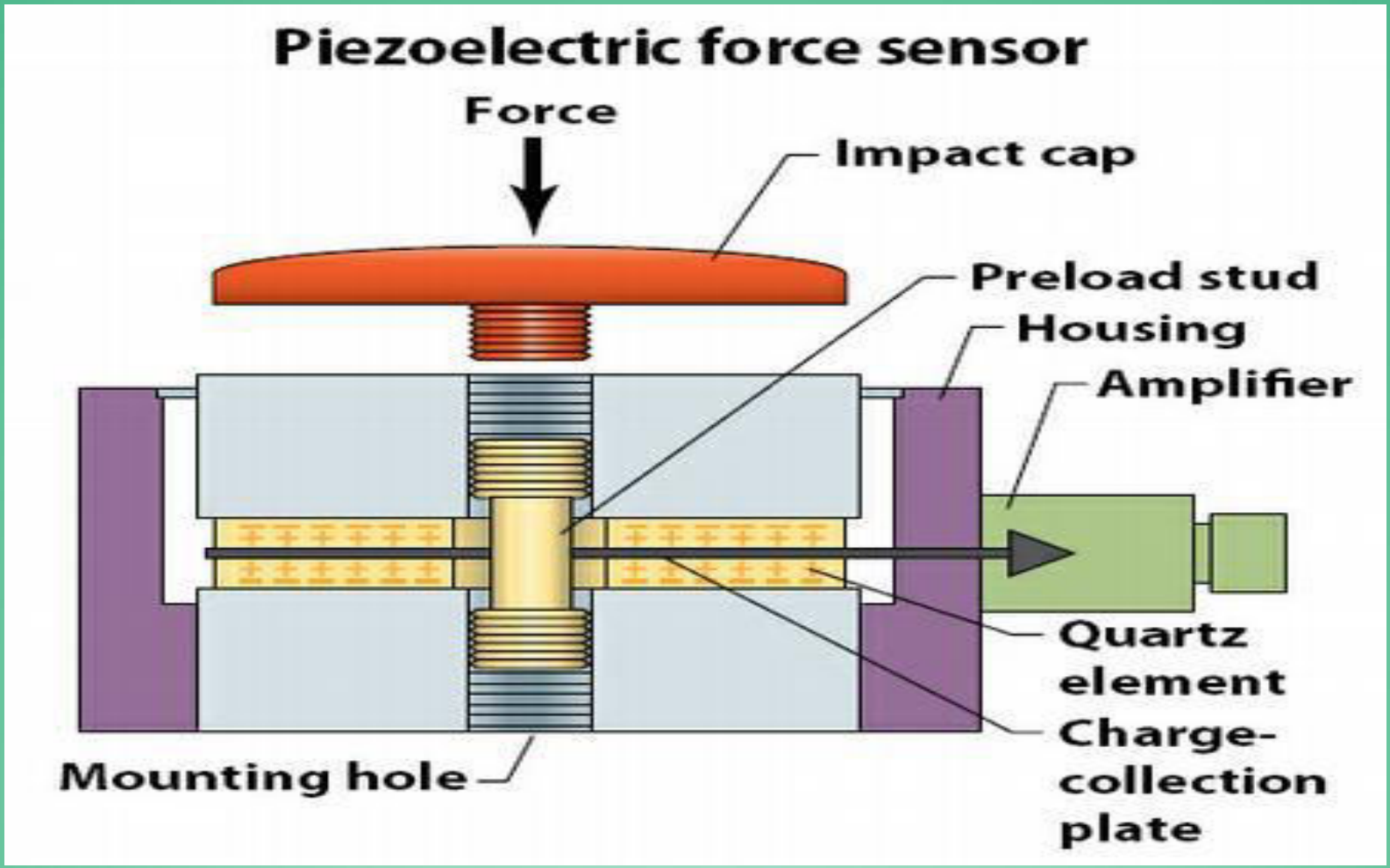


FIG: a) RANDOM ORIENTATION OF DOMAINS PRIOR TO POLING.
b) REMANENT POLARIZATION AFTER FIELD IS REMOVED.

CONTD.

- When the crystal is compressed, the ions in each unit cell are displaced, causing the electric polarization of the unit cell.
- Because of the regularity of crystalline structure, these effects accumulate, causing the appearance of an electric potential difference between certain faces of the crystal.
- When an external electric field is applied to the crystal, the ions in each unit cell are displaced by electrostatic forces, resulting in the mechanical deformation of the whole crystal.


Piezoelectric force sensor
Force
Impact cap
Preload stud
Housing
Amplifier
Quartz element
Charge-collection plate
Mounting hole

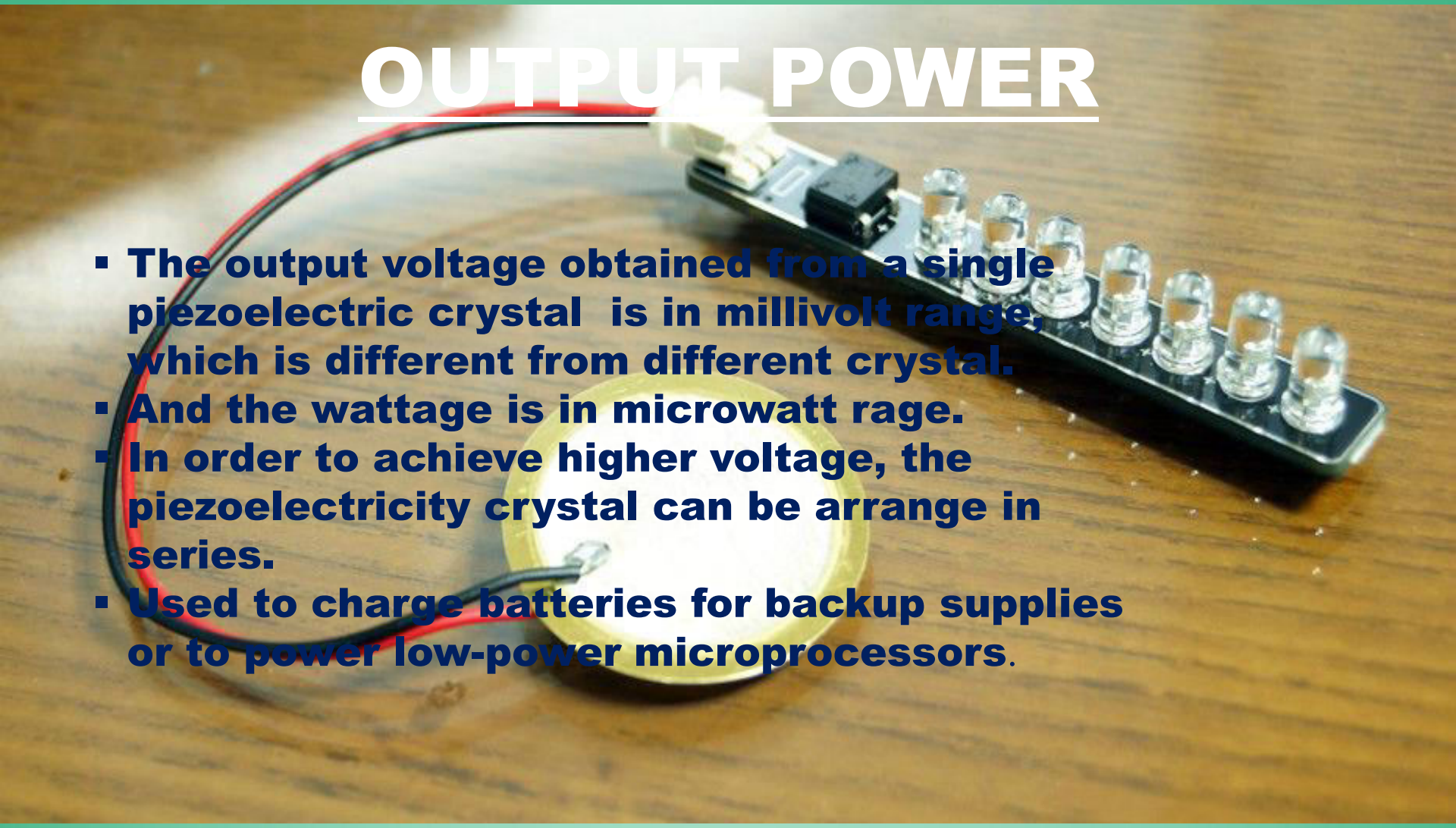
PIEZOELECTRIC EFFECT IN ACTION

APPLICATIONS

PIEZOELECTRIC ENERGY HARVESTING

- POWER GENERATING SIDEWALK.
- GYM AND WORKPLACE.
- MOBILE KEYPADS & BKEYBORAD.
- POWER GENERATIONG BOOTS OR SHOES.
- FLOORMATES AND POWERED DANCE CLUBES.
- ELECTRIC CIGRETTE LIGHTER.
- AS SENSING ELEMENTS.

OUTPUT POWER



- The output voltage obtained from a single piezoelectric crystal is in millivolt range, which is different from different crystal.
- And the wattage is in microwatt rage.
- In order to achieve higher voltage, the piezoelectricity crystal can be arrange in series.
- Used to charge batteries for backup supplies or to power low-power microprocessors.

FUTURE ASPECTS

The report provides forecasts for piezoelectric energy harvesters for the following application segments.

- **Pavements,**
- **Roads,**
- **railroads Lighters and other electrical**
- **Consumer Electronics**
- **Other industrial Switches**
- **Remote Controls**
- **Pushbutton industrial sensors**
- **Electronic locks/access control devices**
- **Toys and gadgets**
- **Military**
- **Aerospace**
- **Vehicle sensors**
- **Healthcare.**

CONCLUSION

- PIEZOELECTRICITY is a revolutionary source for “GREEN ENERGY”.
- Convert the ambient vibration energy surrounding them into electric energy.
- Electric energy can then be used to power other devices or stored for later use.

Renewable Energy Potential - Present Assessment

- Wind - 302 GW (at 100 meter hub height)
- Solar Power - 750 GW
- Biomass Power - 25 GW
- Small Hydro - 20 GW

MNRE

- The Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India for all matters relating to new and renewable energy. The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country.

Creation CASE and Ministry:

- Commission for Additional Sources of Energy (CASE) in 1981.
- Department of Non-Conventional Energy Sources (DNES) in 1982.
- Ministry of Non-Conventional Energy Sources (MNES) renamed as Ministry of New and Renewable Energy (MNRE) in 2006.

Mandate of MNRE

Nodal Ministry for all matters relating to New and Renewable Energy covering:

- Wind energy
- Solar Energy
- Small Hydro Power (up to 25 MW)
- Bio-energy - Biomass/ Bio-wastes including agricultural/urban & industrial
- New Energy Sources such as hydrogen geothermal, tidal, etc.

Policy and regulatory framework for Renewable Energy(RE)

Electricity Act (EA), 2003

Central Government to develop a national policy for optimal utilization of resources including RE.

- Promotes RE by ensuring grid connectivity & sale of RE.
- SERC's to fix a minimum percentage energy purchase from RE sources and to determine tariffs for the promotion of RE.

National Electricity Policy (NEP), 2005

- Capital cost reduction in RE through competition.
- SERCs should specify appropriate tariffs to promote RE and specify targets for RE.
- Promotes private participation in RE.

National Tariff Policy (NTP), 2006

- A minimum percentage procurement should be made applicable latest by April 1, 2006.
- A preferential tariff to be determined by SERC to enable RET's to compete.
- Procurement of RE by distribution licensee through competitive bidding

National Action Plan on Climate Change

- The plan identifies eight core "National Missions" running through 2017

Future Plans

- Both Grid-tied and off-grid/battery charging small wind turbines are available globally.
- The Solar Off-grid scheme & Solar Rooftop (grid-tied) scheme of the Ministry has a provision to support installation of wind solar hybrid systems.
- A detailed guideline for installation of wind-solar hybrid systems under off-grid solar is under progress.
- Grid-interactive small wind turbine/hybrid systems under net metering policy will boost the sector in line with solar rooftop PV.
- NABL accreditation of NIWE' s Small wind turbine testing facility at Kayathar.

THANK YOU