NON CONVENTIONAL ENERGY SOURCES

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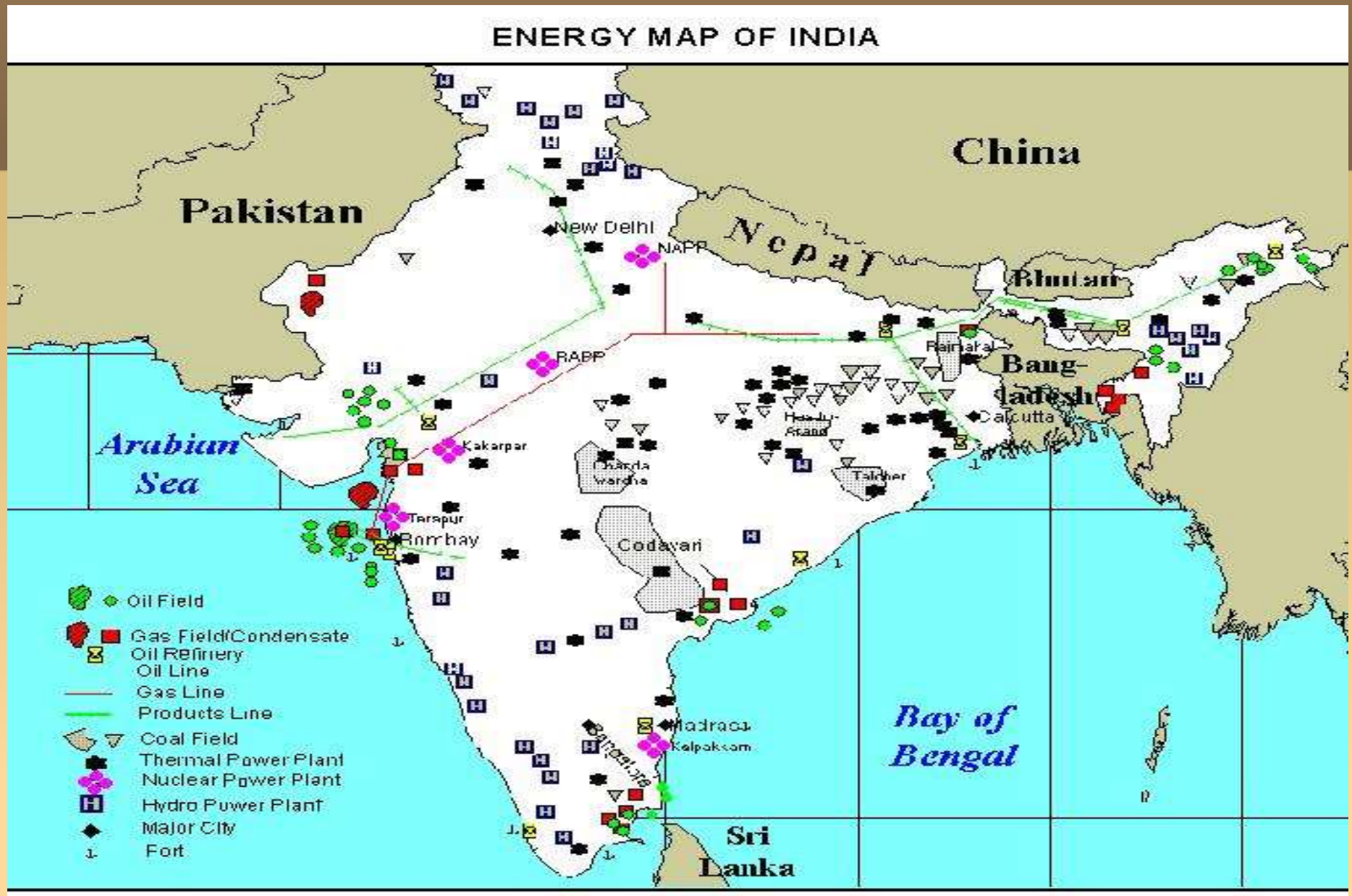
EXISTING POWER SOURCES

- **Thermal Plants:** s.
  - Non-renewable raw material, which is on the verge of extinction.
  - Pollution creator.
- **Hydro Plants:** .
  - Huge investment and large areas required.
  - Unpredictable raw material.
  - Adjacent lower areas are under the threat of floods due to them.
- **Nuclear Plants:**
  - Non-renewable raw material, even that has to be imported from foreign countries.
  - Pollution creator.
- **Gaseous Plants:**
  - Non-renewable raw material, even that has to be imported from foreign countries.
  - Pollution creator.


ENERGY MAP OF INDIA
China
Pakistan
New Delhi
NAPP
Nepal
Bhutan
RAPP
Rajasthan
Bangladesh
Calcutta
Arabian Sea
Kakarpar
Tarapur
Bombay
Codavari
Madras
Kalpakkam
Bay of Bengal
Sri Lanka
Oil Field
Gas Field/Condensate
Oil Refinery
Oil Line
Gas Line
Products Line
Coal Field
Thermal Power Plant
Nuclear Power Plant
Hydro Power Plant
Major City
Fort

World energy

Primary Energy Source	%of World Energy
Oil	34
Natural gas	21
Coal gas	23
Uranium	07
Water flow	02
Bio gas	12
Wind energy	<1

Non conventional energy sources

Solar Energy

- **Solar Photo Voltaic (SPV)** technology enables
  - direct conversion of sun light into electricity ,has no moving parts,s
- Solar Electricity can be used to run pumps, lights, refrigerators, TV sets, etc.

Types of Solar Technologies

- Solar design in architecture
- Solar heating systems
- Solar cooking
- Solar lighting
- Photovoltaics
- Solar thermal electric power plants

Total Installations of solar PV system in Sunderbans

Types of PV systems	Aggregate capacity	Benefited household	Population covered
Solar Power Plants	550kW	3000	16,000
Solar home system	35W to 74W per household	35000	2,00,000

Vast use of Solar PV system in the Region

- Recycled car batteries are used for powering the television, refrigeration etc not only at day time but also during night hours and cloudy days and therefore, there is a demand for solar home systems/battery charging stations in the un-electrified regions.
- So the Consumer purchase the complete solar module-cum-lamps thereby reducing the cost of services.
- In order to establish the lamps charging stations, prototype of solar lamps based on 6V, 14 Ah spill proof flooded type battery with junctions box was to be developed by Jadavpur University.

SOLAR POWER PLANTS

- Renewable energy source. Available at large as compared to human requirement.
- Cost free raw material.
- Pollution free.
- Can be installed at consumer site, resulting in lower T&D losses.
- Can be operated with little maintenance after initial setup.
- Economically competitive where grid connection or fuel transport is difficult.
- Can be easily privatized.

EVEN MOON HAS SOME BLACK SPOTS ON IT

- Limited areal power density.
- Intermittent
- Solar cells produce DC which has to be converted into AC when used in currently existing distribution grids.
- Locations at high latitude reduce potential for solar power use.

BIO ENERGY

- Biomass is renewable energy resource derived from numerous sources like
  - Household wastes,
  - By – product of Industry,
  - Agricultural Crops,
  - Materials from Forest,
  - Cattle Wastes, etc.

BIO FUELS

- Biomass can be converted directly into liquid fuels for use in cars, trucks, buses, trains, etc..
- Ethanol is an alcohol made by fermenting starch, sugar or cellulose.
- Biodiesel is produced from sunflowers, soyabeans, rapeseed (canola).

Biomass Generation

- Sugar industries can generate electricity using bagasse, the left over of sugarcanes.
- About 300 MW of power has already been commissioned.

Hydro Energy

- In order to produce enough electricity, a hydroelectric system requires locations with change in elevation or water head.
- India has the potential of small and mini micro hydel energy of over 10,000 MW. Small hydro power projects of 3MW have been installed and the total capacity is about 350 MW.

- Small hydro projects do not require large dams or cause problem of deforestation, and rehabilitation.
- Hilly regions in India, are endowed with rich hydal resources.
- Mini (upto 1000KW) and micro (upto 100KW) power projects can supply electricity to schools, hotels, in hilly and isolated areas.

Fuel Cells

- Unlike a battery that stores energy fuel cells convert fuel energy directly into electrical energy.
- A fuel, usually hydrogen is supplied to the fuel cell anode.

Wind energy

- The turbine is mounted on a tall structure to enhance energy capture.
- Kinetic energy of wind is captured by Wind turbines consisting of two or more blades mechanically coupled to a generator.

WIND FARM

Energy Storage

- Operation of a wind turbine is not practical at very high or very low wind speeds.
- When the power generated exceeds the demand, the excess energy would be stored for use at other times.

Batteries

Battery storage is used to accumulate the available energy so that the electrical load of the house can be met on demand during periods of inadequate wind. It is also place near the house together with the controller and inverter. The role of battery is also to damp out the high frequency fluctuations in supply and demand.

World status of wind power system

Region	Total installed power up to the end of year 2000(in MW)
World total	18,449
Germany	6,107
Spain	2836
USA	2619
Denmark	2341
India	1220
Netherlands	473
Great Britain	425

Ocean Energy

- Ocean contains thermal energy from sun’s heat and mechanical energy from tides and waves.
- Ocean thermal energy is utilized to vaporize a working fluid which has a low boiling point such as ammonia.
- The vapour expands and turns a turbine.
- Tidal energy is converted into electricity through turbines activating a generator.

Renewable energy potential and achievement

Source/ Technologies	Potential/ availability	Potential exploited
Biogas Plant	12 million	3.128 million
Biomass/bagasse based cogeneration	19,000MW	343 MW
Solar PV Power	47KWh/Sq.m per day	62 MW
Small hydro(<50MW)	15,000 MW	1663 MW
Wind energy	45,000 MW	1507 MW
Ocean thermal	50,000 MW	Nil
Sea wave power	20,000 MW	Nil
Tidal power	9,000 MW	Nil

Source: Ministry of Non-Conventional Energy Sources (MNES)

- India has at present an installed generating capacity of nearly 107Giga watts. This comprises
  - 70 percent thermal (coal, gas, liquid fuel);
  - 25 percent hydro;
  - 3 percent nuclear;
  - And 2 percent wind and power.

Ninety percent of the installed capacity is owned by the public sector (60 percent under state governments and 30 percent under the central government) and the balance about 10 percent by the private sector.

India Energy Consumption in 2010,2020

	2000	2010	2020	Average annual growth (%) 1996-2020
Oil (million barrels per day)	1.9	3.1	4.1	3.8
Natural gas (Trillon cubic feet)	1.2	2.8	5.0	8.6
Coal (million short tons)	371	465	536	2.2
Electricity (billion KWh)	493	802	1192	4.9
Hydroelectricity (quadrillion BTU)	1.2	1.6	2.6	5.3

Source : EIA /DOE

Conclusion

Since India is very large country and there is a number of remote locations in Rajasthan, Bihar, Uttar Pradesh, western areas like in Assam where Renewableenergy power plants can be employed at the consumer site itself.

So more and more use of this Easily and vastly available energy should be made to get the maximum out of it and postpone the risk of Power Crisis.

Solar radiations and its measurements

Introduction

- Radiations:
- Heat transfer by radiation has velocity of propagation equal to 2.997925 m/s.
- Range of 0.2 to 4.0 micrometer
- Solar energy consists of

about 8% ultraviolet radiations (short wavelength)<0.39 μm

46% visible light 0.39-0.78 μm

46% infrared radiations (long wavelength)>0.78 μm

Solar radiations at the earth surface

- Direct radiations: reaches the ground directly from the sun are called direct radiations.
- Diffuse radiations: are that solar radiations received from the sun after its direction has been changed by reflection and scattering by the atmosphere.
- Insolation: is defined as the total solar radiations received on the horizontal surface of unit area on the ground in unit time.

(i) On the altitude of the sun in the sky.

Which further depends upon time.

Some terms

- Attenuation of beam : variation in solar radiation reaching the earth than received at the outside of the atmosphere is due to absorption and scattering in atmosphere.
- Absorption: As solar radiation passes through the earth's atmosphere the short wave ultraviolet rays are absorbed by the ozone layer in the atmosphere and the long wave infrared waves are absorbed by the carbon dioxide and the moisture in the atmosphere.
- Scattering : As solar radiation passes through the earth's surface the components of the atmosphere such as water vapour and dust, scatter a portion of the radiation.

Solar constant

- This is the amount of energy received in unit time on a unit area perpendicular to the sun's direction at the mean distance of the earth from the sun.1367 W/m^2

Solar radiations measurements

Two basic types of instruments:

(1) Pyrheliometer:A pyrheliometer is an instrument which measures beam radiations.(Direct radiations)

Principle of working is thermopile effect.

mechanically they must follow the sun radiations to measure direct sunlight and to avoid the diffused component. (2)Pyranometer:

An instrument for the measurement of the global solar radiation received from the entire hemisphere with the shading rings to cut the direct sun light.

References

- G.D. Rai, ‘Non-Conventional Energy Sources’, Khanna Publishers, Delhi, **2011.**