ENVIRONMENTAL STUDIES
15CIV18

UNIT-II ENERGY

- ENERGY
- DIFFERENT TYPES OF ENERGY

• Conventional

• Non - Conventional sources

- ADVANTAGES AND LIMITATIONS

•Wind Mills ,Hydro Electric

•Fossil fuel, Nuclear, Solar

•Biomass and Bio-gas, Geothermal energy

Energy

Energy

It is great word, which is defined as the ability or capacity to do work.

- **We use energy to do work and make all movements.**
- **When we eat, our body transform the food into energy to do work.**
- **When we run or walk or do some work, we ‘ burn’ energy in our bodies.**
- **Cars, planes, boats machinery etc. also transform energy into work.**

Work means moving or lifting something, warming or lifting something. There are many sources of energy that help to run the various machines invented by man.

- **Energy is measured in Joule**
  - **The energy unit used for everyday electricity, particularly for utility bills, is the kilowatt-hour (kWh); one kWh is equivalent to 3.6×106 J**

Energy

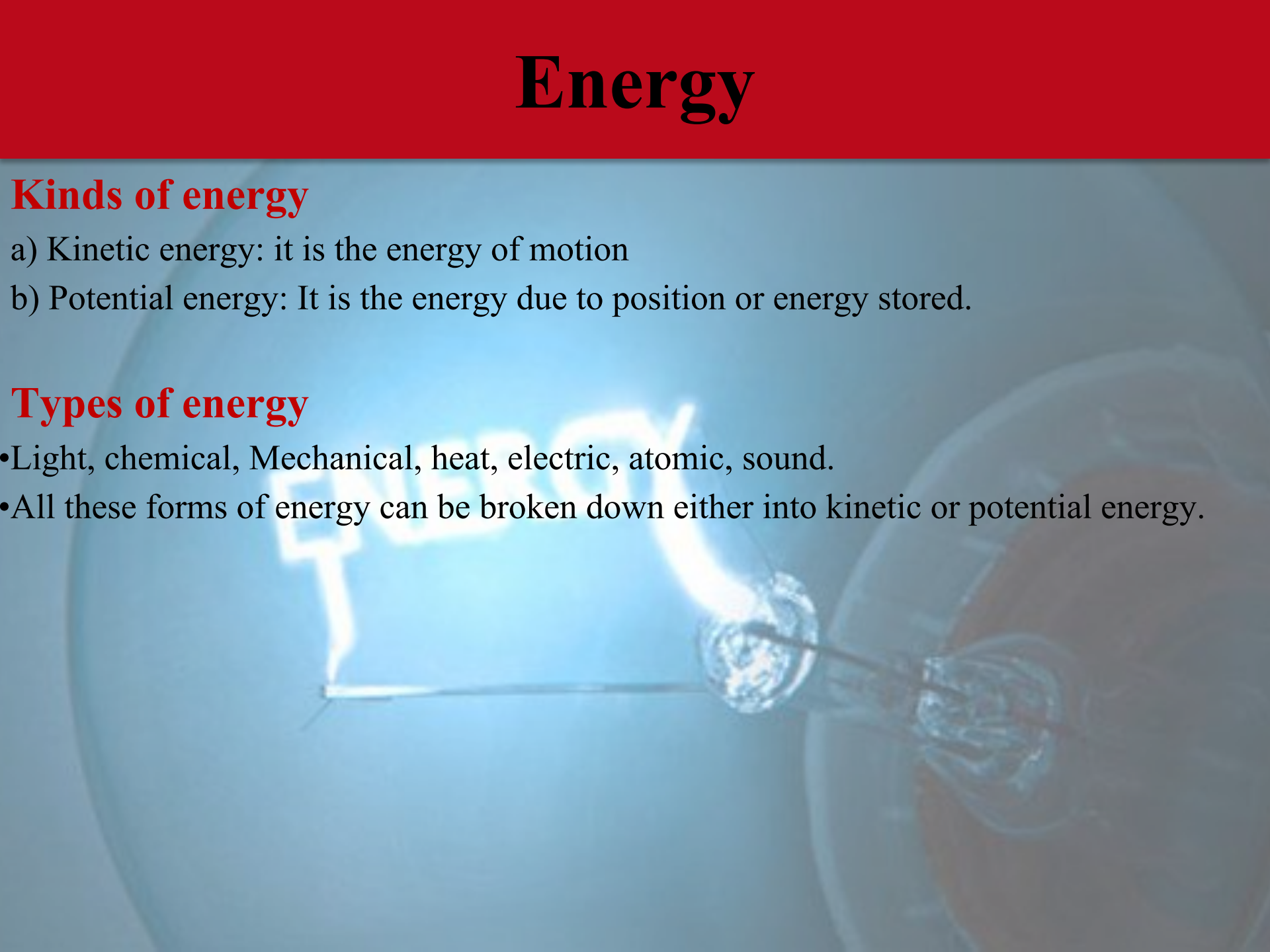
Kinds of energy

a) Kinetic energy: it is the energy of motion

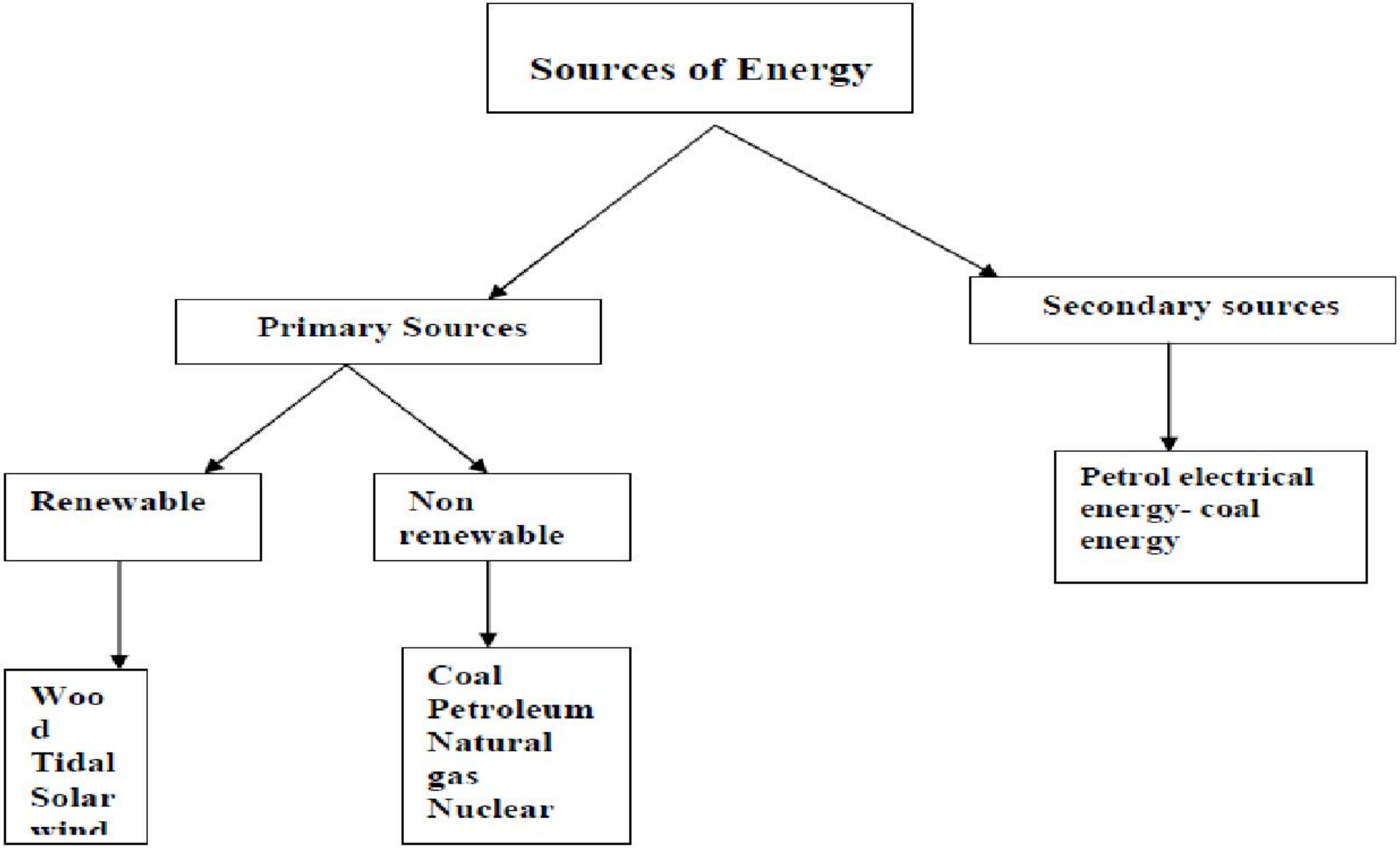
b) Potential energy: It is the energy due to position or energy stored.

Types of energy

- Light, chemical, Mechanical, heat, electric, atomic, sound.
- All these forms of energy can be broken down either into kinetic or potential energy.



Energy


Sources of Energy
Primary Sources
Secondary sources
Renewable
Non renewable
Petrol electrical energy- coal energy
Woo d Tidal Solar wind
Coal Petroleum Natural gas Nuclear

Energy

Primary

Energy resources are mined or otherwise obtained from the environment.

Ex.

a. Fossil fuels: coal, lignite, crude oil, Natural gas etc.

b. Nuclear fuels: Uranium, Thorium, and other nuclear elements used in fission reaction.

c. Hydro energy : It is energy of falling water, used to turn a turbine.

d. Geo thermal: The heat from the underground stream .

e. Solar energy: Electromagnetic radiation from the Sun.

f. Wind energy: The energy from moving air used by wind mills.

g. Tidal energy: The energy associated with the rise and fall of the tidal waters.

Energy

Table 1: ***Different Sources of Energy***

Energy Source	Percentage of total energy	Sub total percentage
A) Non- renewable Sources		
Oil	32	
Coal	21	
Natural gas	23	
Nuclear	6	82
B) Renewable Sources		
Bio mass(mainly wood)	11	
Solar, wind, hydro and Geothermal power	7	18
	Total	100

Energy

Global energy consumption patterns:

- **Transportation consumes about 24% of the energy, 40% for industry, 30% for domestic and commercial purposes and remaining 6% for other uses including agriculture.**
- **The top 20 richest countries of the world use different forms energy i.e. many countries consumes 80% of the natural gas, 65% of the oil and 50% of the coal every year.**
  - **What is natural gas?**
  - Natural gas is a fossil energy source that formed deep beneath the earth's surface. Natural gas contains many different compounds. The largest component of natural gas is methane, a compound with one carbon atom and four hydrogen atoms (CH4). Natural gas also contains smaller amounts of natural gas liquids (NGL; which are also hydrocarbon gas liquids
- **One third of the world's population has lack access to adequate energy supplies , they mainly depend on fuel wood, dung, coal, charcoal and kerosene for cooking and heating. U.S.A is the largest energy consumer in the world.**

Energy

- India's energy status is not promising. Presently, the country consumes about 100 million tones of coal and 32.5 million tones of oil annually.
- Official estimate report that 40 billion tones of coal are available but only one half this is recoverable which means it is less than the projected demand of 23 billion tones of coal till the year 2020.
- On the other hand the projected demand for hydroelectric power by 2020 is 12 times more than the present installed capacity of nearly 15, 000 MW.
- India's oil deposits Is about 400 million tones as against the world oil reserve of 750,000 million tones.
- Gas reserves of our country is about 100 million cubic meters, as against world's reserves of 163,000 million cubic meters.
- Here, one can conclude that the energy Scenario of India is not in a better condition.

Energy

The energy demands

Increases with progress in human civilization.

Quantum of energy consumption is a measure of the quality of life or living standard.

Per capita energy consumption

In USA, 200 million British Thermal Units (BTU)

in UK 125 million BTU

in Japan 50 million BTU and

in India 5 million BTU.

1 BTU = energy required to raise the temperature of 1 lb. of water by 1°F

Animation of Renewable Energy Sources.mp4

Conventional Energy Resources

Introduction

1780

Invention of Steam Engine brought about

INDUSTRIAL REVOLUTION

in

BRITAIN.

1799

Invention of

BATTERY,

the first source of stored electric current by VOLTA.

Conventional Energy Resources…..Contd

1820

Demonstration of Production of electricity using

DYNAMO

By

Michael Faraday.

Middle of 19th century

Generation of electricity using heat of steam

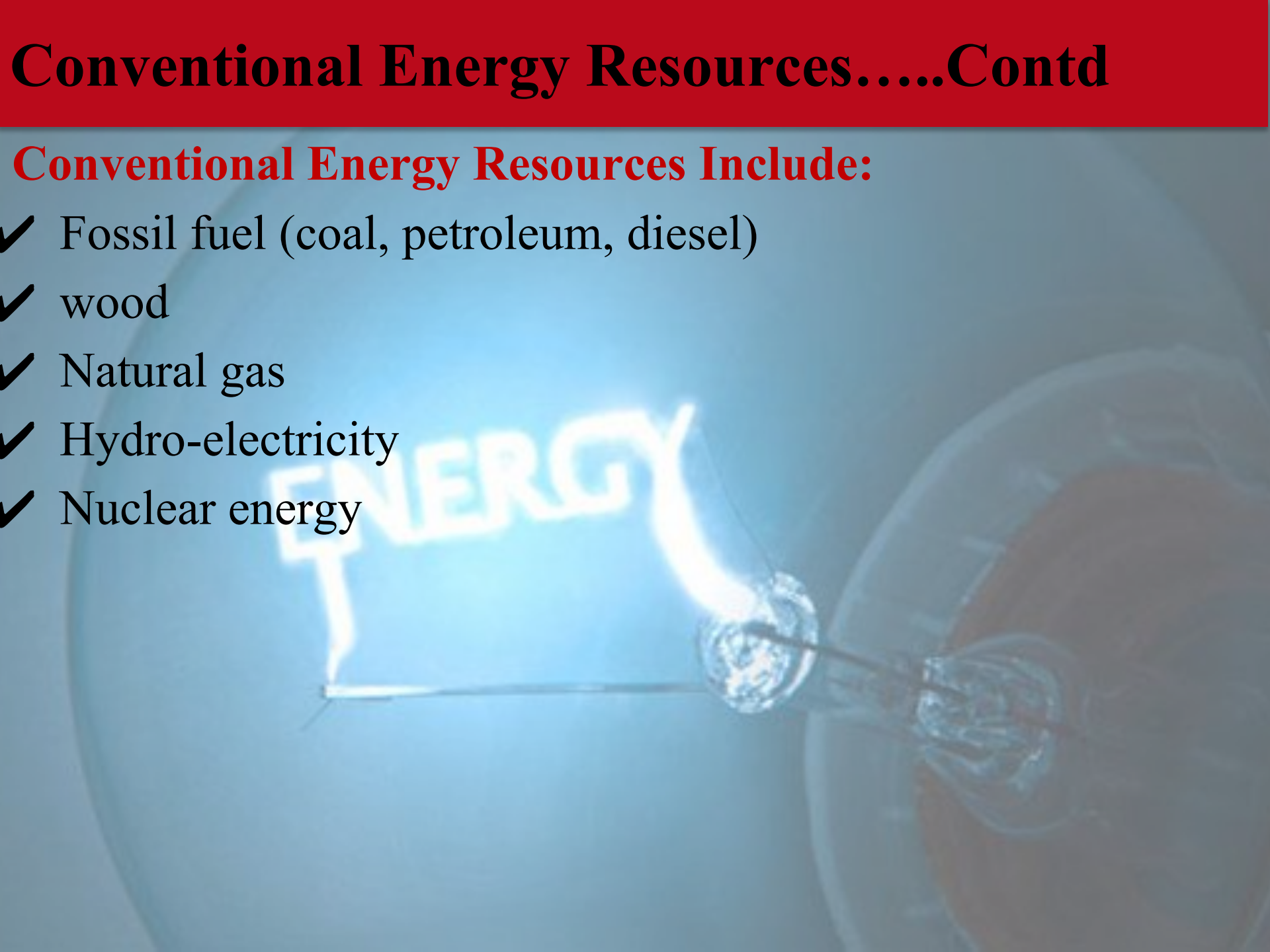
i.e.

THERMAL POWER PRODUCTION

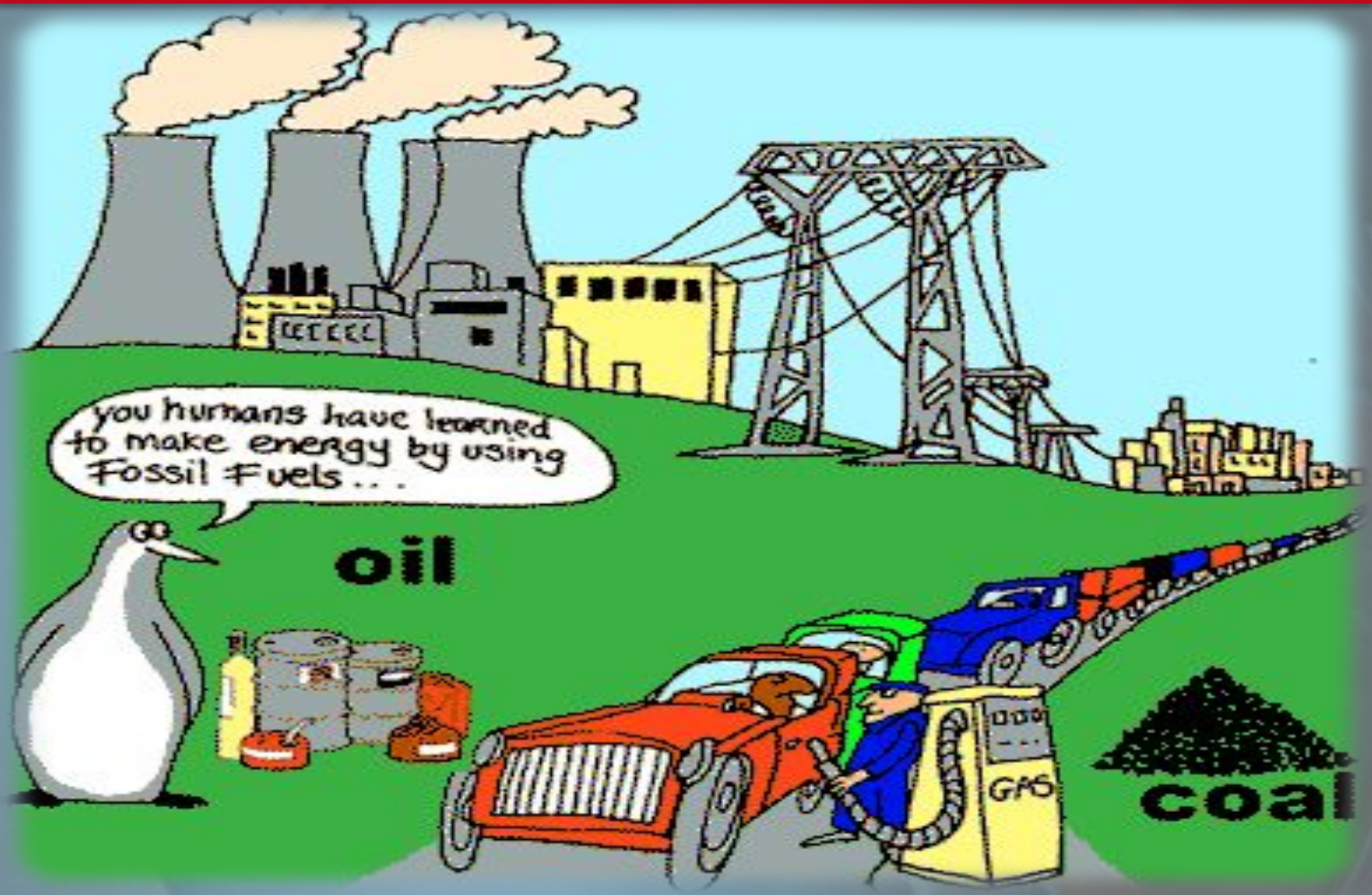
Conventional Energy Resources…..Contd

Conventional Energy Resources Include:

- ✔ Fossil fuel (coal, petroleum, diesel)
- ✔ wood
- ✔ Natural gas
- ✔ Hydro-electricity
- ✔ Nuclear energy



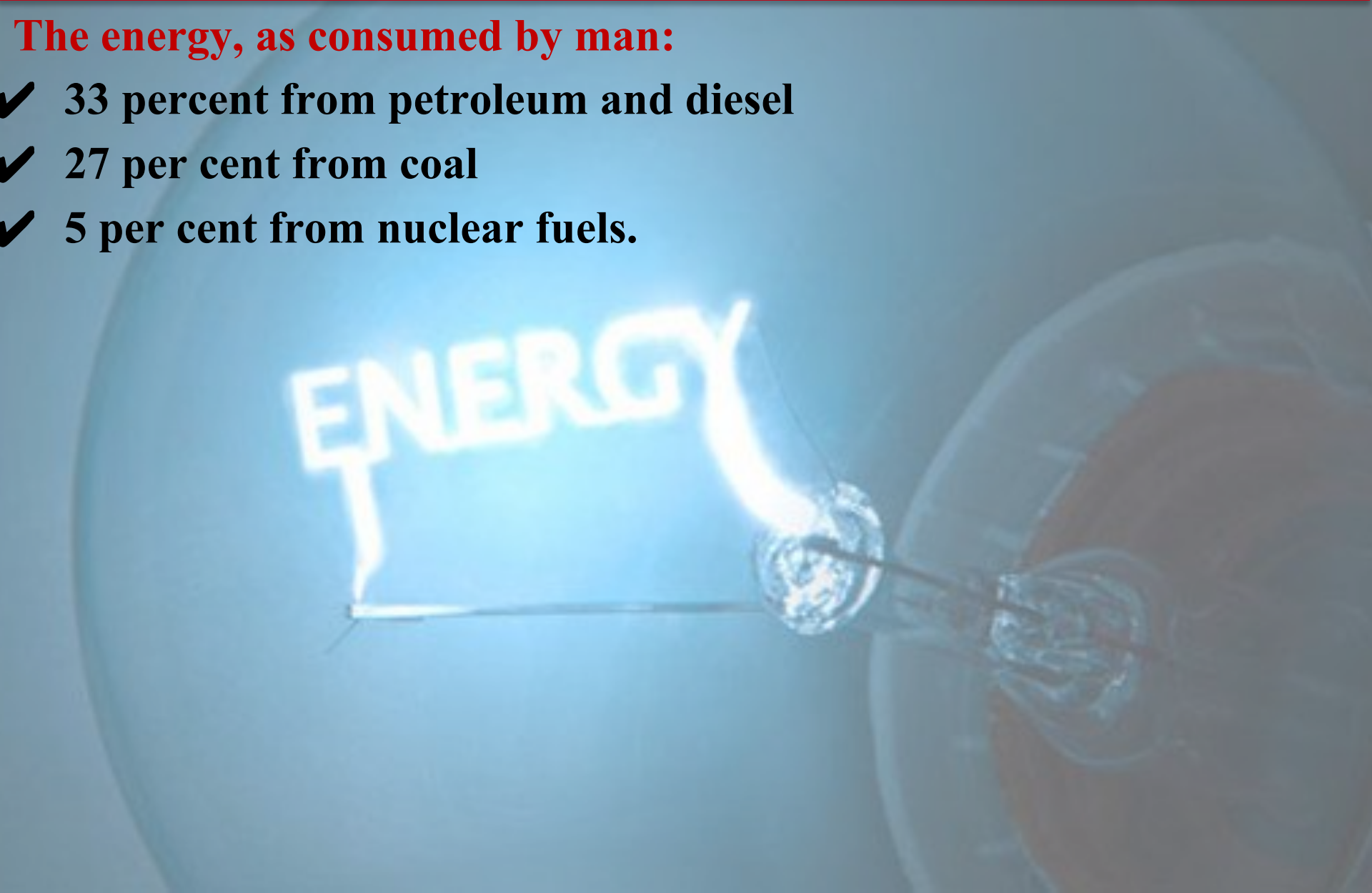
Conventional Energy Resources…..Contd



Conventional Energy Resources…..Contd

The energy, as consumed by man:

- ✔ **33 percent from petroleum and diesel**
- ✔ **27 per cent from coal**
- ✔ **5 per cent from nuclear fuels.**



Conventional Energy Resources…..Contd

COAL

- Coal is substantially more abundant than oil or gas
- The total coal deposits : 7×10^{12} metric tonnes.

This is 1000 times more than the total global energy consumption from all fuels.

The stock of coal is likely to last several centuries.

Conventional Energy Resources…..Contd

COAL

On combustion,

- **It emits sulphur dioxide which is an offensive gas.**
- **Forms sulphuric acid in air and may cause acid rain in far-away places posing environmental hazards.**
- **Excavation of coal from mines is followed by soil subsidence (depression) which endangers the residential areas above the coal mines.**
- **Moreover, fly ash arising from combustion of coal is a nuisance as solid waste and brings about environmental problems.**

Conventional Energy Resources…..Contd

- **Also being a solid, coal is less convenient to handle than petroleum or natural gas.**

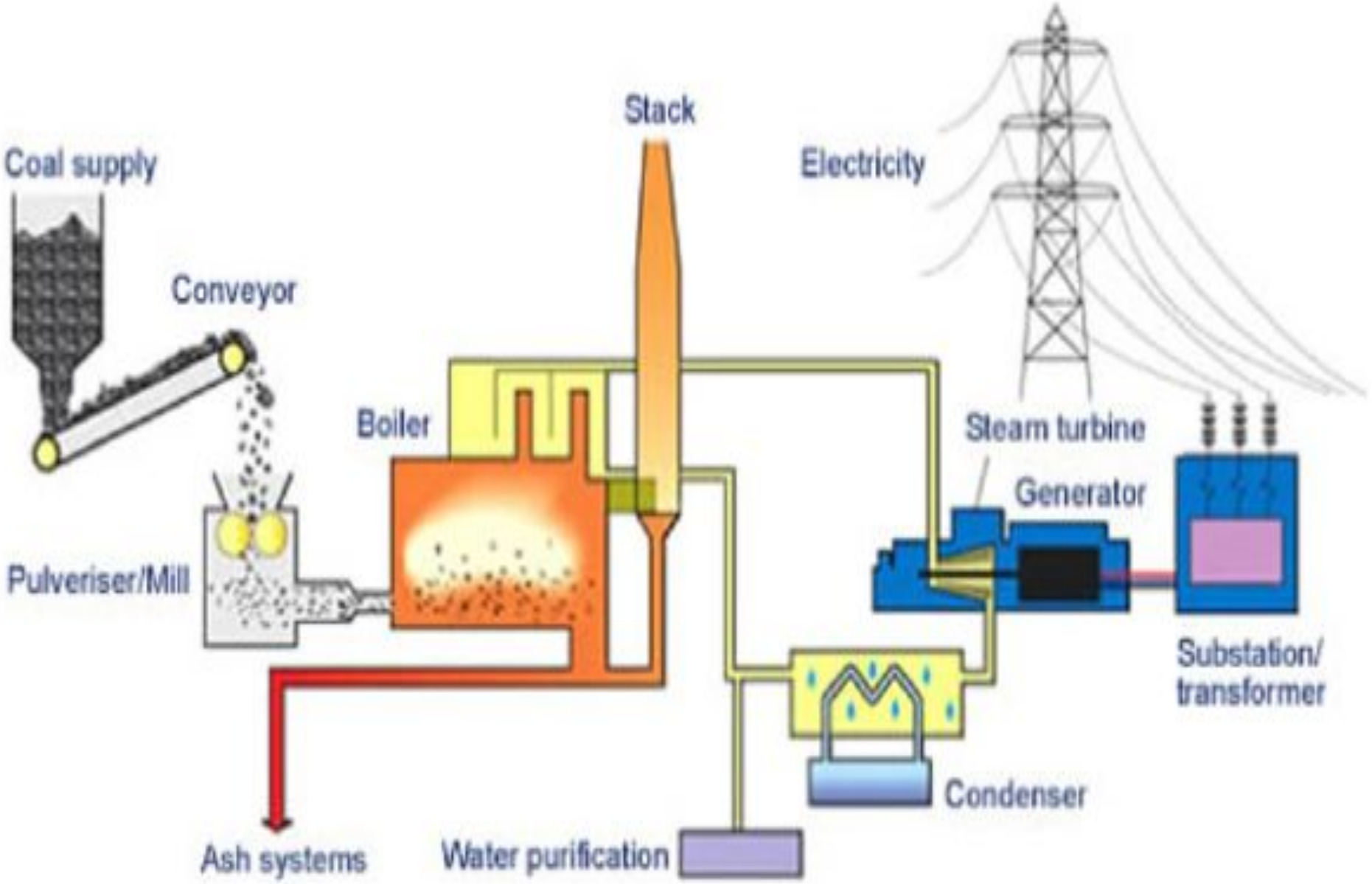
- **In order to overcome these problems, the developed countries use less polluting forms of coal by transforming it into gaseous, liquid or low sulphur, low-ash solid fuel.**

Conventional Energy Resources…..Contd

THERMAL POWER

- The heat generated by combustion of coal in a furnace is utilized to produce steam at high temperature and pressure.
- This steam is then used to run a steam turbine which is linked with the generator producing electricity.
- Thermal power stations are operated on the above principle by combustion of coal in a furnace.

Conventional Energy Resources…contd



Conventional Energy Resources…contd

Thermal power…contd

Thermal power contributes

- **About 65,000 MW of electricity i.e.. 70 per cent of India's power supply.**
- **Thermal Power Corporation of Karnataka are at:**

✔ **Raichur Thermal power plant**

✔ **Bellary thermal power plant**

They are the sources of severe air pollution.

Conventional Energy Resources…contd

PETROLEUM OR MINERAL OIL

- **The consumption of petroleum and natural gas is maximum in the developed countries.**

- **USA is the largest consumer of petroleum in the world (about 80 per cent of total energy consumption in USA).**

Though Industrial Revolution (1780) was initially fuelled by coal, later on preference was given to oil and gas which provide cleaner fuels and easy transportation.

Conventional Energy Resources…contd

The world's petroleum reserve is about

800 billion barrels

(1 barrel =31.5 gallons = 120 litres)

which will last for less than 100 years.

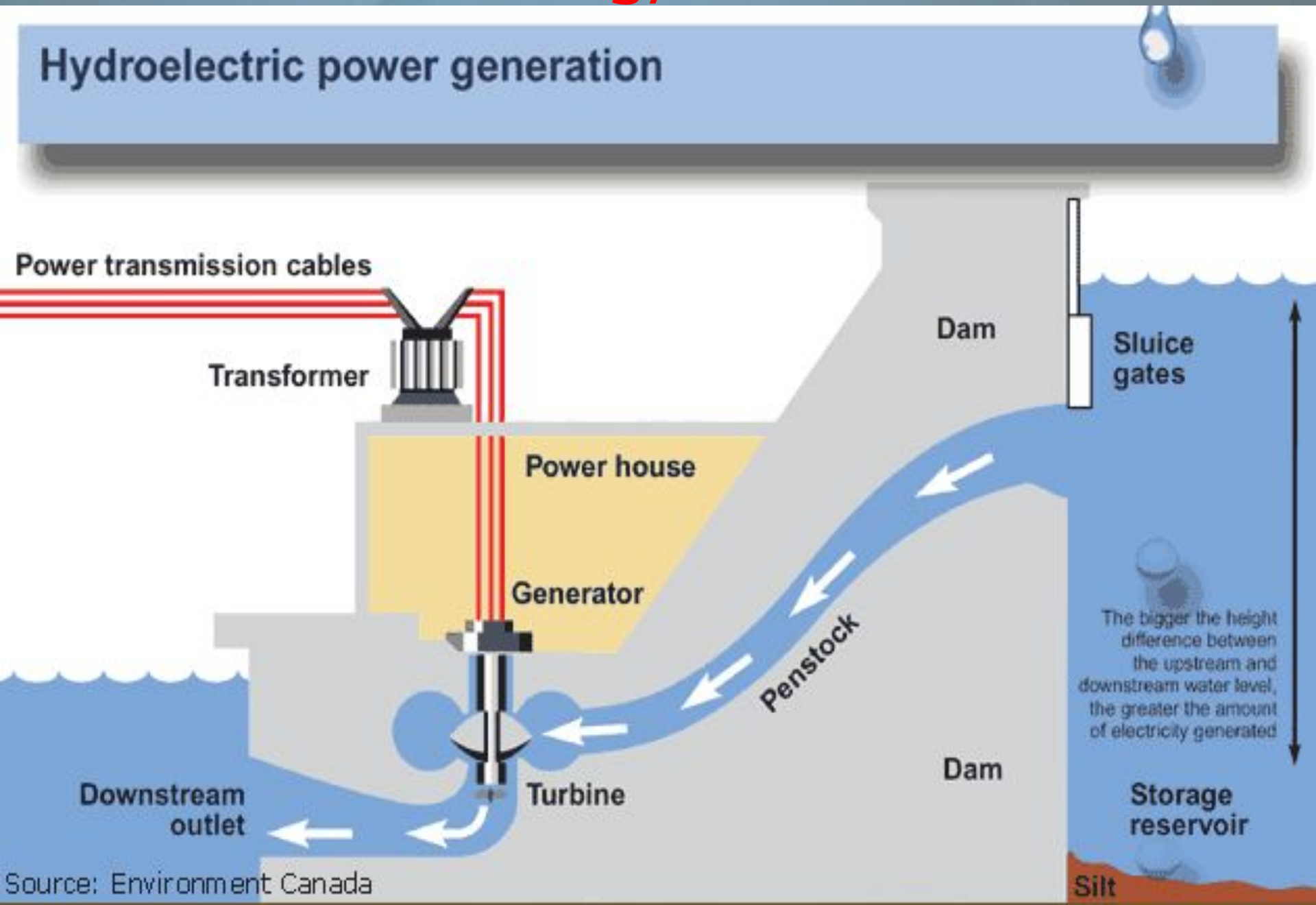
Conventional Energy Resources…contd

HYDROELECTRICITY

Hydroelectricity accounts for
21 per cent of total electricity generation,
which is less than that from thermal power
but greater than that from nuclear power.

In India,
if water resources are properly utilised,
it may be possible to generate more than
10,000 megawatts of electricity.
But at present,
only 16 per cent
of hydroelectricity is generated.

Conventional Energy Resources… Contd



Conventional Energy Resources…contd

- **Hydel projects utilise the kinetic energy of water for generation of electricity .**

- **In practice, a water reservoir is constructed by means of dam across a river for storage of water.**

- **Subsequently the stored water is released from upper level into a water-driven turbine placed at a lower level, which is linked to a generator whereby electricity is generated.**

The typical examples of Hydel projects :

Sharavati Hydel Project, Kali river Project, Almatti Hydel project

Almatti Hydel project, Bagalkot

Conventional Energy Resources…contd

The merits of hydroelectricity are:

(1) Clean source of energy
(2) No Emission of greenhouse gases
(3) No consumption of fuel
(4) No Need of high technology

Conventional Energy Resources…contd

But there are several environmental issues:

- **Flora and fauna in the region are disturbed due to construction of dam**
- **Local people become refugees as they are uprooted from their house**
- **The capacity of the reservoir gets reduced due to siltation**
- **Occurrence of floods in the area when surplus water has to be discharged in monsoon season**
- **Hydroelectric dams are costly and take a longtime for construction.**

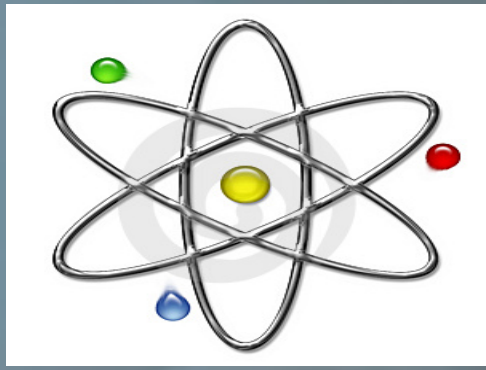
Conventional Energy Resources…contd

In order to make hydroelectricity generation **viable,**
it is necessary to adopt
a long-term programme of
afforestation,
environmental conservation,
housing,
public health,
transport and
ensure close co-ordination among
these departments.

Kinetic and Potential Energy (clip).mp4

Conventional Energy Resources…contd

NUCLEAR POWER



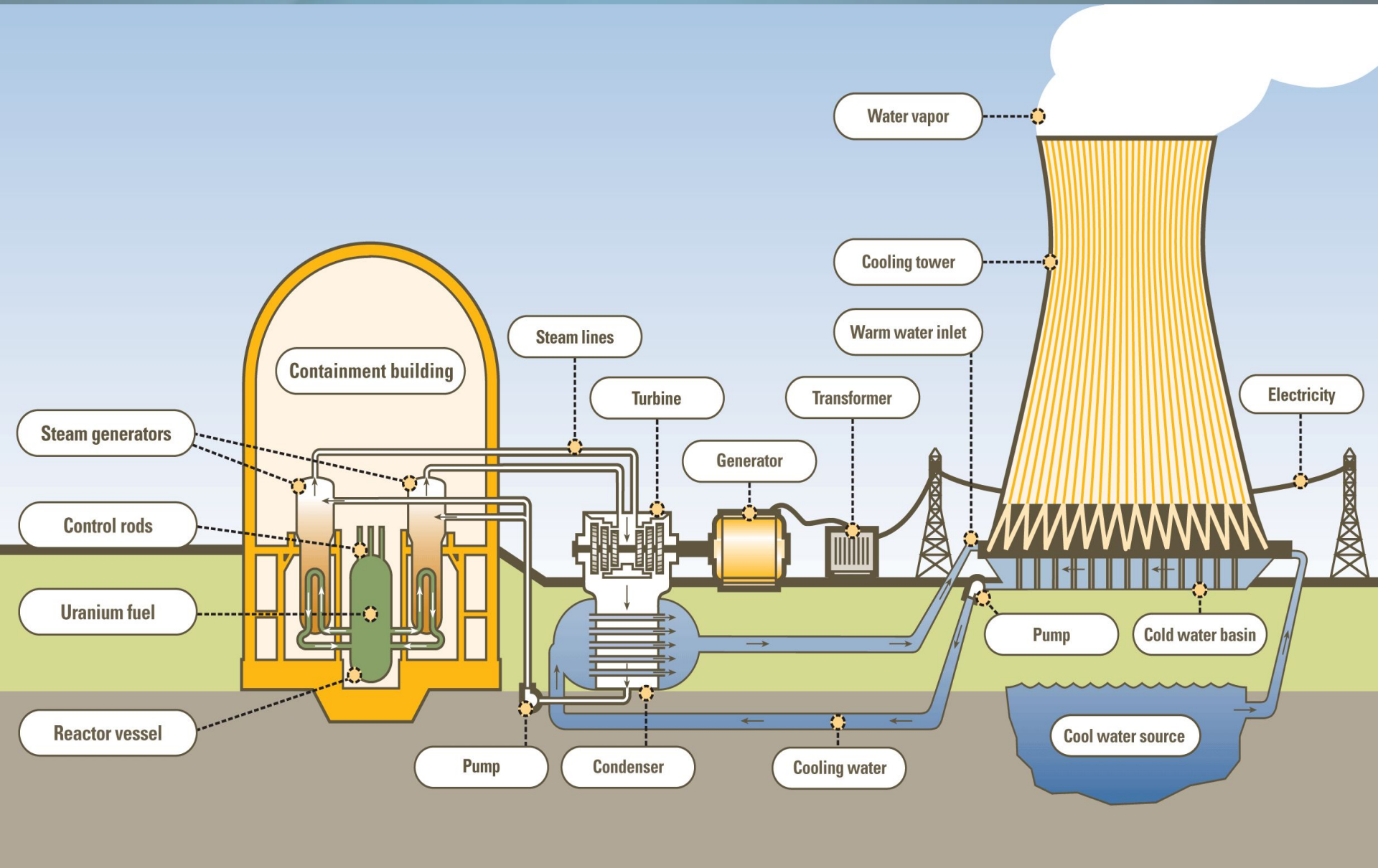
- It contributes only 5 per cent of total electricity generation.
- Nuclear power plants do not emit polluting gases such as carbon dioxide, sulphur dioxide like thermal power plants.

Some of the severe drawbacks of Nuclear Power:

- They are costly and release large quantities of radioactive fission products.
- The radioactive wastes remain lethal (deadly) for thousands of years.
- No fool-proof method of disposal of radioactive wastes.
- That is why big nuclear power projects have not succeeded in the long run.

Conventional Energy Resources… contd

Nuclear power plant schematic diagram



Conventional Energy Resources…contd

In India,

As of 2013 India has 21 Nuclear reactors in operation and 7 nuclear power plants, with installed capacity of 5780MW and producing a total of 30,392.91GWof electricity.

Nuclear power plants cannot match thermal power plants at present. But in future, Its unlimited resources will allow it to dominate the energy scenario when other Energy resources are exhausted.

Conventional Energy Resources…contd

- **At present,**

Nuclear fission is used to produce nuclear power.

Heavy large atoms like Uranium and Plutonium split up into smaller atoms when bombarded by neutrons.

This splitting or fission liberates vast amounts of energy, which through conventional techniques is converted into electricity.

It has been estimated that 1 lb of Uranium-235 is equivalent to 5 million lbs of coal.

Conventional Energy Resources…contd

NATURAL GAS

A better fossil fuel than coal and petroleum since on burning, it produces less carbon dioxide.

- **It is a naturally occurring hydrocarbon gas mixture consisting primarily of methane, but commonly including varying amounts of other higher alkanes and some times a small percentage of carbon dioxide, Nitrogen and hydrogen sulfide.**

Conventional Energy Resources…contd

Hence,

Natural Gas should be the obvious choice as a cleaner fuel.

Its reserves however, are limited and can continue to feed only for the next 70-80 years.

At present, in India

the exploitable reserve of natural gas is about 700 billion cubic metres.

Non-conventional Energy Resources

SOLAR ENERGY

India- A tropical country

Blessed with abundant sunshine

At about 2,000 kilowatt hour/sq. metre (kWh/m^2) per year for about 200-300 days in a year. i.e. daily sunshine is between 5-7 kWh per sq.m

Non-conventional Energy Resources

This enormous energy resource is :

Clean,

Pollution-free and

Inexpensive.

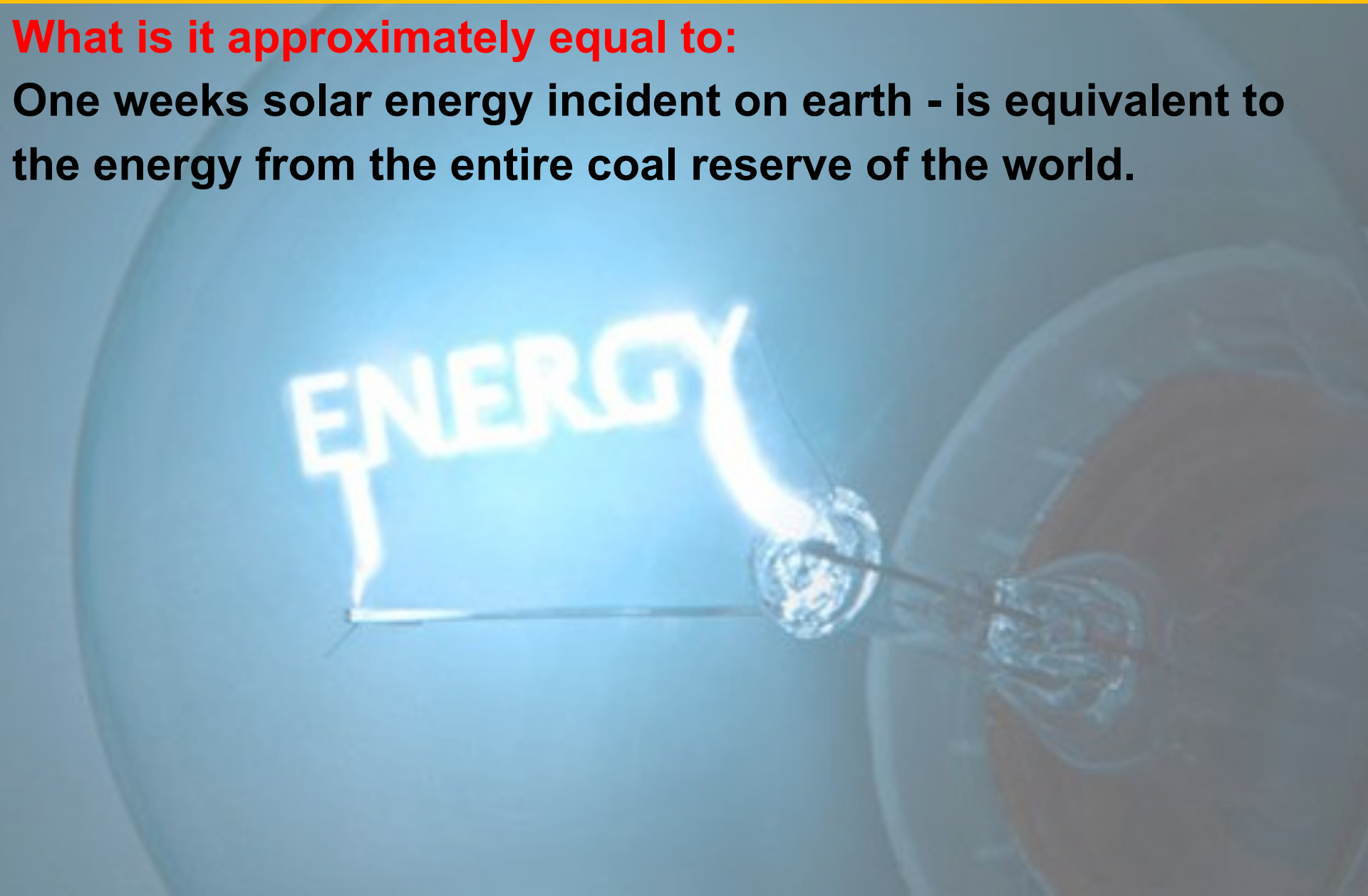
However,

Requires to be converted into other forms of energy by suitable techniques to meet our energy demands.

Non-conventional Energy Resources

What is it approximately equal to:

One weeks solar energy incident on earth - is equivalent to the energy from the entire coal reserve of the world.



Non-conventional Energy Resources

However,

- The major problem with solar energy is that sunlight is diffused (widespread) in nature and difficult to be stored and utilized.

- At present, solar energy is ten times more expensive than thermal power.

- Needs advanced technology for conversion involving high costs.

- Solar energy can be utilized on a large scale only if there is drastic reduction in costs.

Non-conventional Energy Resources

Sunlight may be directly converted into :

Electricity through photovoltaic cell

(conversion of light energy into electrical energy, with an efficiency of only 18 per cent.)

We can use solar energy in two ways:

(1) use of solar heat to boil water or dry food grains.

(2) use of solar electricity.

Accordingly, several gadgets have been developed:

- ✔ **solar cooker (for cooking),**
- ✔ **solar dryer (for drying grains),**
- ✔ **solar water heater (for heating water),**
- ✔ **solar distillation (for water purification) etc**

Non-conventional Energy Resources

By using the second method, solar energy can be converted into electricity using solar cells called silicon cells.

The advantages of solar photo-voltaic cells :

- They can replace systems which use diesel.
- They are free from chemical and noise pollutions.
- They could be installed in remote areas in forests and deserts where installation of electric cables are cost-prohibitive.

Non-conventional Energy Resources

How Solar Energy Panels Work.mp4

Non-conventional Energy Resources

Department of Non-conventional Energy Source (DNES), Government of India offers subsidy for:

- solar streetlights and
- solar pumps (for irrigation)
- solar heating devices

It is desirable to use:

solar cookers in villages on a large scale so that extensive deforestation can be prevented.

Non-conventional Energy Resources

BIOGAS

- ✔ Offers an important solution to the present energy crisis in rural areas.
- ✔ An important domestic energy source
- ✔ Offers an environmentally-clean technology.
- ✔ There is a vast reserve of biogas in Indian villages.

It is estimated that :

1000 million tonnes of animal dung per year is available from 250 million cattle population.

After allowing for losses and output-efficiency,

Can yield 22,500 million cubic meters of biogas through biogas plants.

Can replace kerosene and save about 14,000 million litres per year in villages.

Non-conventional Energy Resources

Besides,

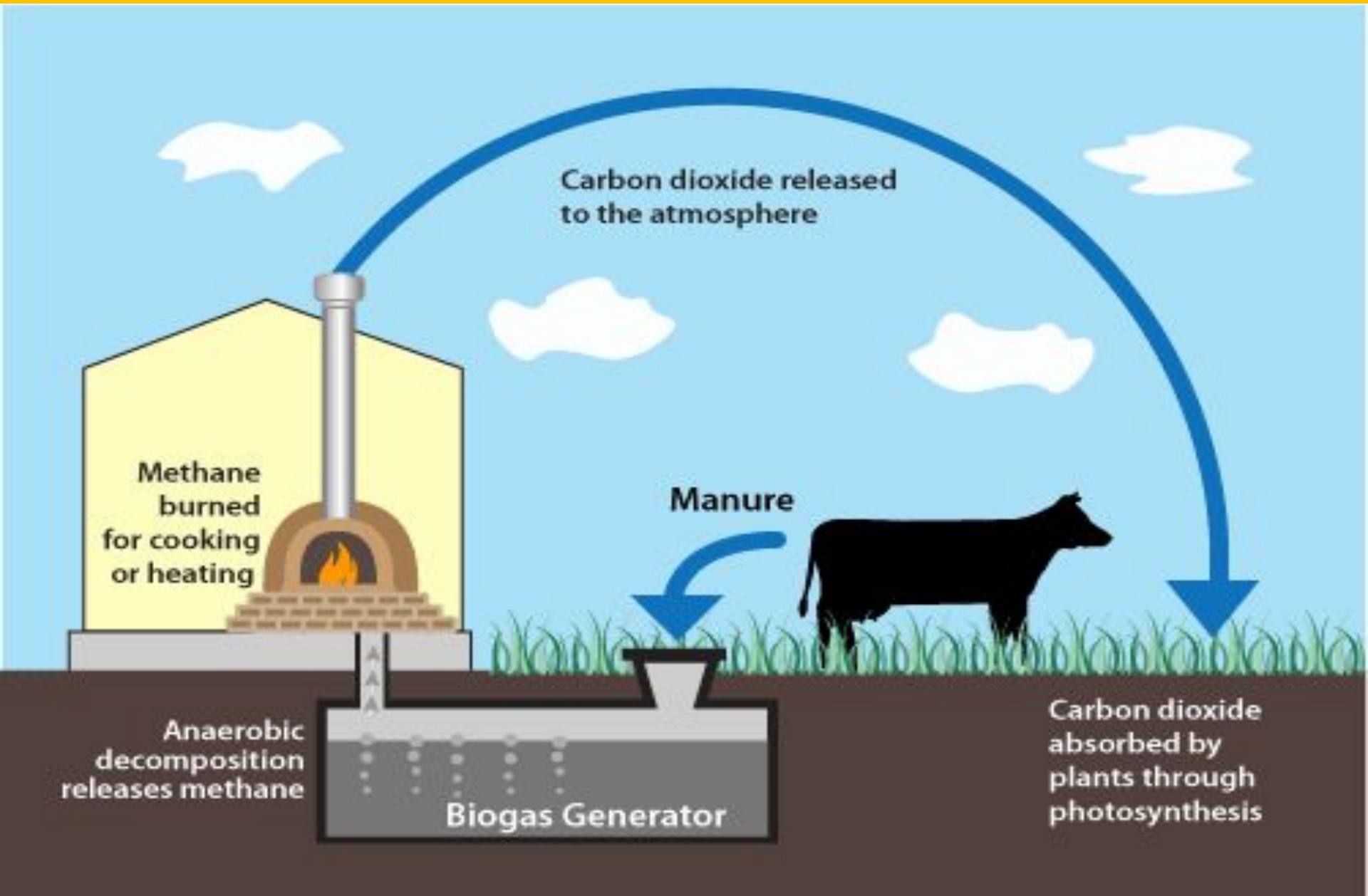
Biogas slurries can produce:

- ✔ 200 million tonnes of excellent organic manure per year.
- ✔ A good substitute for chemical fertilizers for agriculture.

The composition of the biogas is:

- ✔ Methane, carbon-dioxide, hydrogen and nitrogen.
- ✔ The proportion of methane and carbon dioxide varies considerably and accordingly the calorific value of the biogas fuel.

Non-conventional Energy Resources



Non-conventional Energy Resources

WIND ENERGY

A cheap and clean energy resource.

India, with its climatic diversity, has areas which are quite windy.

Non-conventional Energy Resources

According to the Indian Meteorological Department:

Average annual wind velocity is 6.5 m/sec at a number of places in peninsular India, along the coastlines of Gujarat, Western Ghats and parts of central India.

Such velocities are available for 6-7 months in a year.

Major limitation for setting up wind power mills:

They require locations where:

- ✔ **The wind velocity is at least 6.5 metres per second.**
- ✔ **A standard windmill produces 55 kilowatts of electricity daily.**

Non-conventional Energy Resources

In Scotland, Wales, Sweden, Germany and USA, many windmills have been constructed for generation of cheap electricity.

The technology for harnessing wind energy in India is still in the preliminary stage.

The Department of Non-conventional Energy Sources, Government of India has installed several wind pumps.

Non-conventional Energy Resources

To give an idea,

A 100-km stretch of coastline in areas having wind speed of 10 km/hour from sea would lead to an installed capacity of 500 megawatts.

Wind energy can be used advantageously in remote rural areas and would help in saving fossil fuels.

Non-conventional Energy Resources

1. **Wind** blows...
2. across tall **windmills**...
3. to turn the blades of huge **turbines**...
4. which spin **generators** to create electricity.
5. A **transformer** increases the voltage to send electricity over...
6. **distribution** lines. Then local transformers reduce the voltage...
7. for **you** to use.

Non-conventional Energy Resources

GEOTHERMAL ENERGY

- ✔ The earth's core has a vast source of thermal energy.
- ✔ This thermal energy has been tapped in many developed countries.

USA, Philippines, Japan and New Zealand have been working on the exploration of geothermal energy as an energy resource.

In France and Hungary, Hot water from hot springs have been utilized for heating houses and agricultural farms.

Non-conventional Energy Resources

Geothermal Energy Production Animation.mp4

Non-conventional Energy Resources

TIDAL ENERGY

Ocean waves splash on ocean shores at tremendous speed-this mechanical energy (kinetic energy) can be harnessed and converted into electrical energy.

In the middle of North Atlantic Ocean,

Each wave of every 1 metre height can generate 90 kW electricity

whereas on the ocean shore

The waves can generate 25-70 kW.

During storm, the generation level can rise up to 5 mW.

Lots of researches are on in this area in U.K, Canada, Norway and Japan.

Non-conventional Energy Resources

Working process

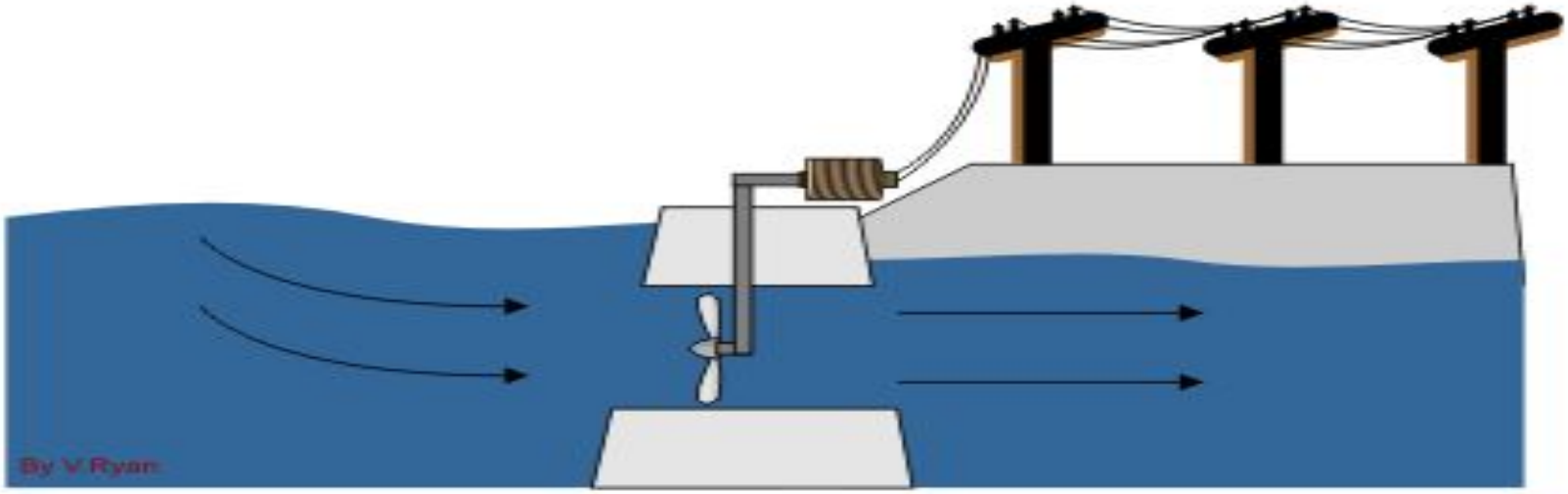
The sea water is enclosed in a large chamber. Ocean/sea wave enters the chamber through an inlet pipe and forces the enclosed water upward at very high speed.

This exerts hydraulic pressure on enclosed air which in turn can rotate a turbine.

This method is very expensive.

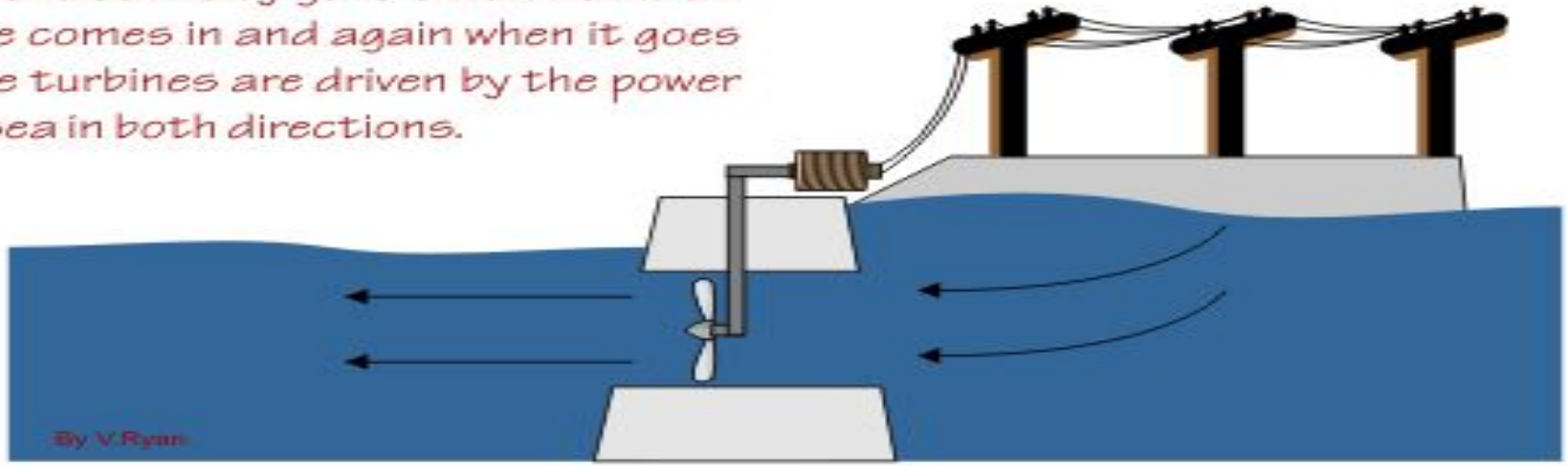
But it has immense potential which can be exploited in future with advanced technology.

Non-conventional Energy Resources



TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.



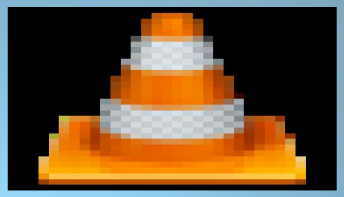
TIDE GOING OUT

Non-conventional Energy Resources

Tidal Energy Pty Ltd animation.mp4

Non-conventional Energy Resources

BIOMASS ENERGY



Biomass energy.mp4

Non-conventional Energy Resources

How does biomass work - Sustainability.mp4


Thank you
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