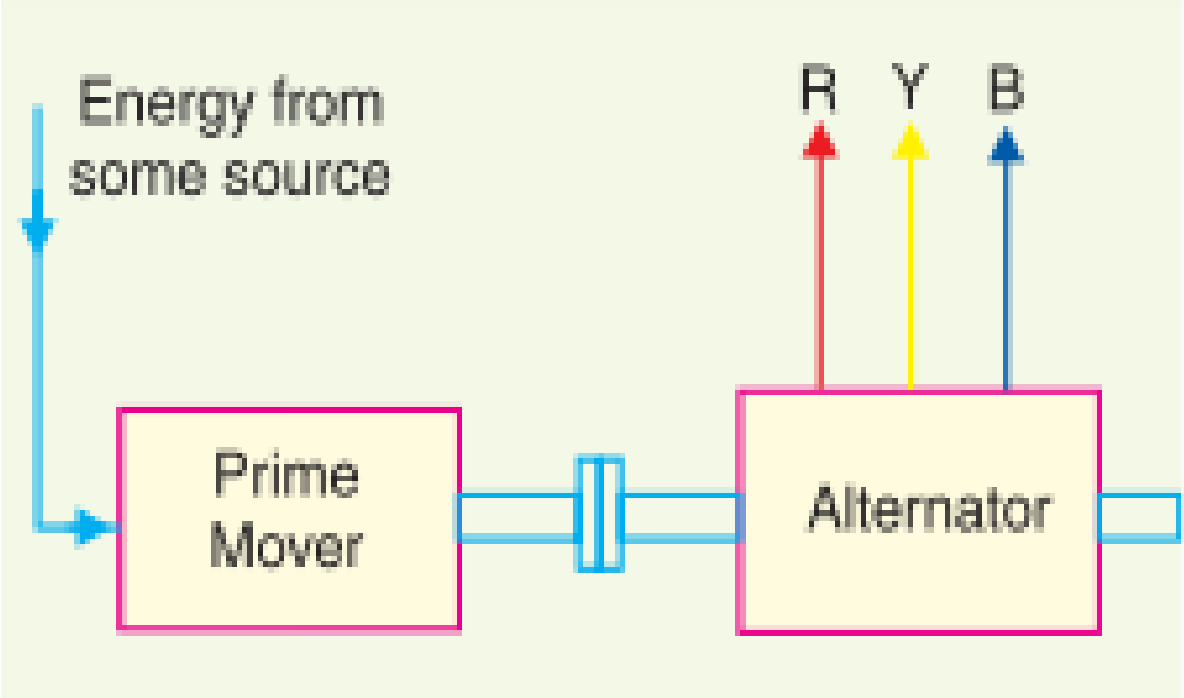
Unit-I

THERMAL POWER STATIONS

Introduction:-

GENERATION OF ELECTRICAL ENERGY

- *The conversion of energy available in different forms in nature into electrical energy is known as* **generation of electrical energy**.
- Energy is available in various forms from different natural sources such as **pressure head of water, chemical energy of fuels, nuclear energy of radioactive substances etc.**
- The following fig shows the basic arrangement for producing electrical power from different sources available in nature



The prime mover is driven by the energy obtained from various sources such as burning of fuel, pressure of water, force of wind etc.

Steam turbine is used as prime mover in thermal power stations

The turbine converts heat energy of steam into mechanical energy which is further converted into electrical energy by the alternator.

THERMAL POWER STATION (STEAM POWER STATION)

Thermal power stations are also known as steam power stations

A generating station which converts heat energy of coal combustion into electrical energy is known as a steam power station.

At 2011, **54.09% or 93918.38 MW** of total electricity production in India is from Coal Based Thermal Power Station.

Production of electrical energy in Thermal power stations

In a coal based power plant, coal is transported from coal mines to the power plant by railway in **wagons or by vehicles**.

Coal is unloaded from the wagons and stored at underground. This coal from the mines is of no uniform size. So it is taken to the **Crusher house** and crushed to a size of 20mm.

The Coal Mills or **pulverizer** pulverizes the coal to 200 mesh size.

Pulverization means converting coal piece to powdered form.

The powdered coal from the coal mills is carried to the boiler where combustion of coal takes place

Combustion is a chemical process between coal (fuel) and air. The output of combustion is heat energy

This heat energy is used to heat the water in the boiler.

The temperature in the boiler is of the order of **1300 deg.C.**

Water is converted to steam in the boiler and steam is separated from water.

The superheated steam from the final super heater is taken to the High Pressure Steam Turbine (HPT).

In the HPT the steam pressure is utilized to rotate the turbine and the resultant is rotational energy.

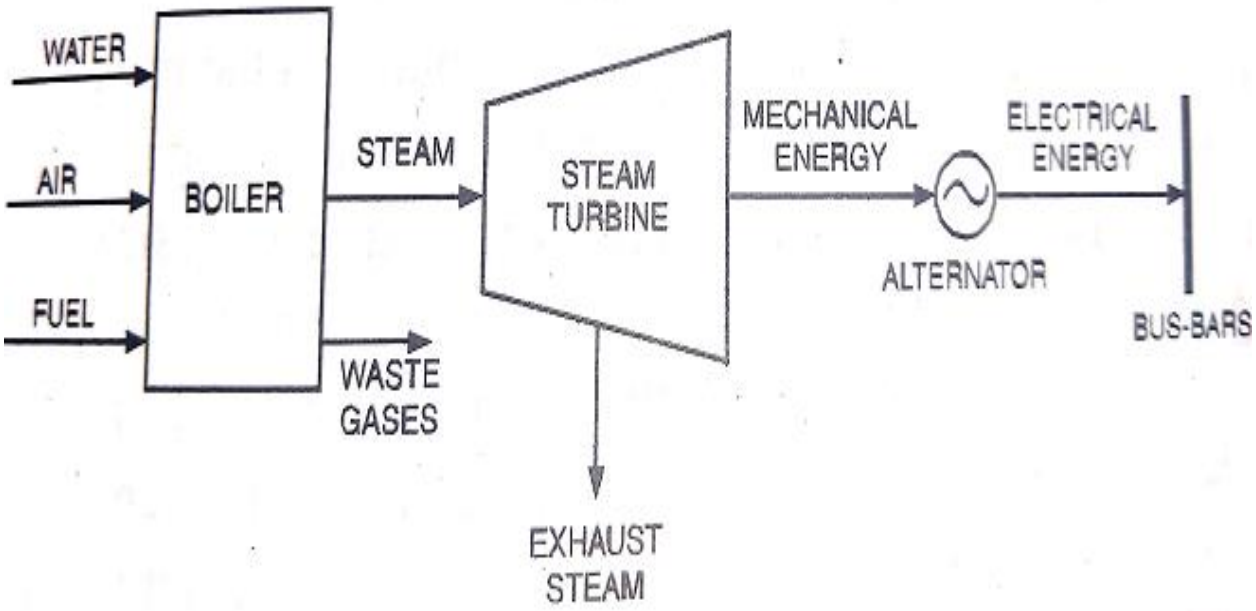
From the HPT the out coming steam is taken to the **Reheater in the boiler** to increase its temperature.

After reheating this steam is taken to the Intermediate Pressure Turbine (IPT) and then to the Low Pressure Turbine (LPT).

The outlet of the LPT is sent to the **condenser for condensing back to water** by a cooling water system.

This condensed water is collected and is again sent to the boiler for producing steam again.

The rotational energy imparted to the turbine by high pressure steam is converted to electrical energy in the Generator.



The brief working of thermal PowerStation is as shown in above figure

SELECTION OF SITE FOR THERMAL POWER PLANT (STEAM):

1. Availability of fuel (coal):

The Thermal Power station should be located near the coal mines so that transportation cost of fuel is minimum. Huge amount of coal is required for raising the steam (20,000 tons per day for a 2000 MW Station). Since the government policy is to use only low grade coal with **30 to 40%** ash content for power generation purposes, the steam power plant should be located near the coal mines to avoid the transport of coal and ash.

2. Availability of water:

Large quantity of water is required in a Thermal Power plant.

It is required for

i) To raise the steam in boiler

ii) For cooling purpose such as in condensers

iii) As a carrying medium such as disposal of ash and

iv) For drinking purposes

Hence, this plant should be located at the bank of a river or near a canal to ensure the continuous supply of water

3. Nearness to the load centres:

The power plant should be as near as possible to the center of the load so that **transmission cost and losses are minimum.** It is possible to install the plant away from the load centers, provided other conditions are favorable.

4. Transportation facilities:

The facilities must be available for transportation of heavy equipment and fuels e.g.. **near railway station**

5. Cost and type of land:

The Thermal Power station should be located at a place where land is cheap and further extension. Moreover, the bearing capacity of the ground should be adequate so that heavy equipment could be installed.

6. Distance from populated area:

As huge amount of coal is burnt in a Thermal Power station, therefore, smoke and fumes pollute the surrounding area. This necessitates that the plant should be located at a considerable distance from the populated areas.

7. Labor Supplies:

Skilled and unskilled laborers should be available at reasonable rates near the site of the plant.

8. Ash disposal:

Ash is the main waste product of the Thermal Power plant and with low grade coal, it may be 3.5 tons per day, hence, some suitable means for disposal of ash should be thought of.

Ash can be used for **brick making** near the plant site, or it can be dumped in to the disused mines, or into the river.

ADVANTAGES OF COAL BASED THERMAL POWER PLANT

(*i*) The fuel (*i.e.*, coal) used is quite cheap.

(*ii*) Less initial cost as compared to other generating stations.

(*iii*) It can be installed at any place irrespective of the existence of coal. The coal can be transported to the site of the plant by rail or road.

(*iv*) It requires less space as compared to the hydroelectric power station.

(*v*) The cost of generation is lesser than that of the diesel power station.

(vi) They can respond to rapidly changing loads without difficulty.

DISADVANTAGES OF COAL BASED THERMAL POWER PLANT

(*i*) It pollutes the atmosphere due to the production of large amount of smoke and fumes.

(*ii*) It is costlier in running cost as compared to hydroelectric plant.

(iii) large quantity of water is required.

(iv) Great difficulty experienced in coal handling.

(v) Problem of ash removing.

(vi) Efficiency is less (30%)

SCHEMATIC ARRANGEMENT OF THERMAL POWER STATION

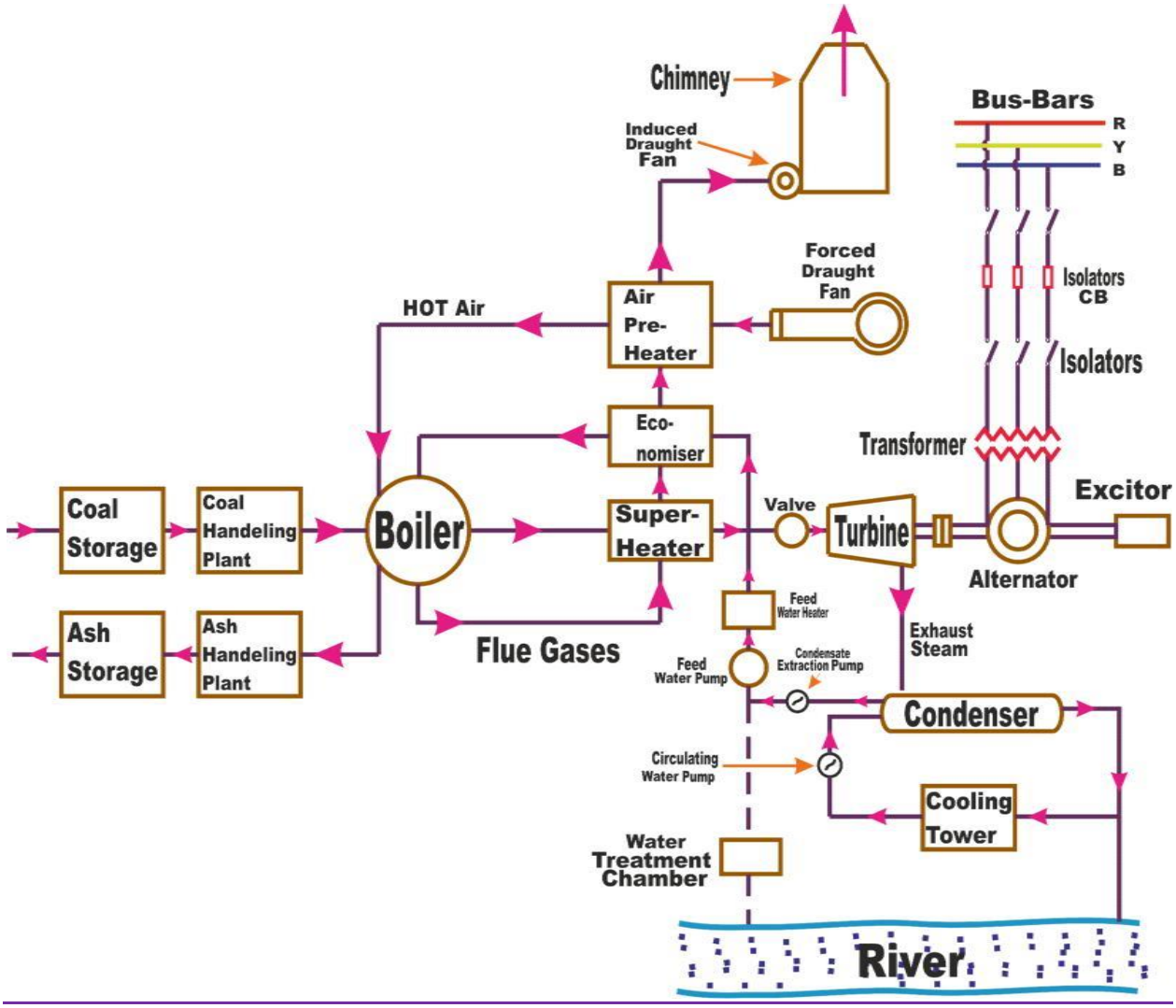
The main functioning parts in thermal power station are

1. Coal and ash handling arrangement
2. Steam generating plant
3. Steam turbine
4. Alternator
5. Feed water
6. Cooling arrangement

1. Coal and ash handling plant.

The coal is transported to the power station by road or rail and is stored in the coal storage plant. Storage of coal is primarily a matter of protection against coal strikes, failure of transportation system and general coal shortages.

From the coal storage plant, coal is delivered to the coal handling plant where it is **pulverized** (*i.e.*, crushed into small pieces) in order to increase its surface exposure, thus promoting rapid combustion without using large quantity of excess air.


Chimney
Induced Draught Fan
Bus-Bars
R
Y
B
Forced Draught Fan
Isolators CB
Isolators
HOT Air
Air Pre-Heater
Eco-nomiser
Transformer
Excitor
Coal Storage
Coal Handeling Plant
Boiler
Super-Heater
Valve
Turbine
Alternator
Feed Water Heater
Exhaust Steam
Ash Storage
Ash Handeling Plant
Flue Gases
Feed Water Pump
Condensate Extraction Pump
Condenser
Circulating Water Pump
Cooling Tower
Water Treatment Chamber
River

2. Steam Generating Plant::

The steam generating plant consists of a **boiler** for the production of steam and other auxiliary equipment for the utilization of flue gases

(i) Boiler.

The heat of combustion of coal in the boiler is utilized to convert **water into steam** at high temperature and pressure. The flue gases from the boiler make their journey through **super-heater, economizer and air pre-heater** and are finally exhausted to atmosphere through the **chimney.**

(ii) Super heater.

The steam produced in the boiler is wet and is passed through a **super heater** where it is dried and superheated (*i.e.*, steam temperature increased above that of boiling point of water) by the **flue gases** on their way to chimney. Superheating provides two principal benefits.

Firstly, the overall efficiency is increased.

Secondly, too much condensation in the last stages of turbine (which would cause blade corrosion) is avoided.

The superheated steam from the super heater is fed to **steam turbine** through the main valve.

(*iii*) *Economiser.*

An economizer is essentially a **feed water heater** and **derives heat from the flue gases** for this purpose. The feed water is fed to the economizer before supplying to the boiler. The economizer extracts a part of heat of flue gases to increase the feed water temperature.

(*iv*) *Air preheater.*

An air preheater **increases the temperature of the air** supplied for coal burning by deriving heat from flue gases. Air is drawn from the atmosphere by a **forced draught fan** and is passed through air preheater before supplying to the boiler furnace.

The air preheater extracts heat from flue gases and increases the temperature of air used for coal combustion.

3. Steam turbine.

The dry and superheated steam from the superheater is fed to the steam turbine through main valve.

The heat energy of steam when passing over the blades of turbine is converted into mechanical energy.

After giving heat energy to the turbine, the steam is exhausted and it is sent to the condenser which condenses the exhausted steam by means of cold water circulation.

4. Alternator.

The steam turbine is coupled to an alternator. **The alternator converts mechanical energy of turbine into electrical energy. The e**lectrical output from the alternator is delivered to the bus bars through transformer, circuit breakers and isolators.

5. Feed water.

The **condensate from the condenser** is used as feed water to the boiler. Some water may be lost in the cycle which is suitably made up from **external water source**.

The feed water on its way to the boiler is **heated by water heaters and economizer**. This helps in raising the overall efficiency of the plant.

6. Cooling arrangement.

Water is drawn from a natural source of supply such as a river, canal or lake and is circulated through the condenser. **The circulating water takes up the heat of the exhausted steam and itself becomes hot.**

This hot water coming out from the condenser is discharged at a suitable location down the river. In case the availability of water from the source of supply is not assured throughout the year, cooling towers are used.

During the scarcity of water in the river, **hot water from the condenser is passed on to the cooling towers where it is cooled.** The cold water from the cooling tower is reused in the condenser.

WORKING PRINCIPLE OF THERMAL POWER PLANT

In thermal power plants, the heat of combustion of fossil fuel (coal, oil, or gas) utilized by the boiler to raise the steam at high pressure and temperature.

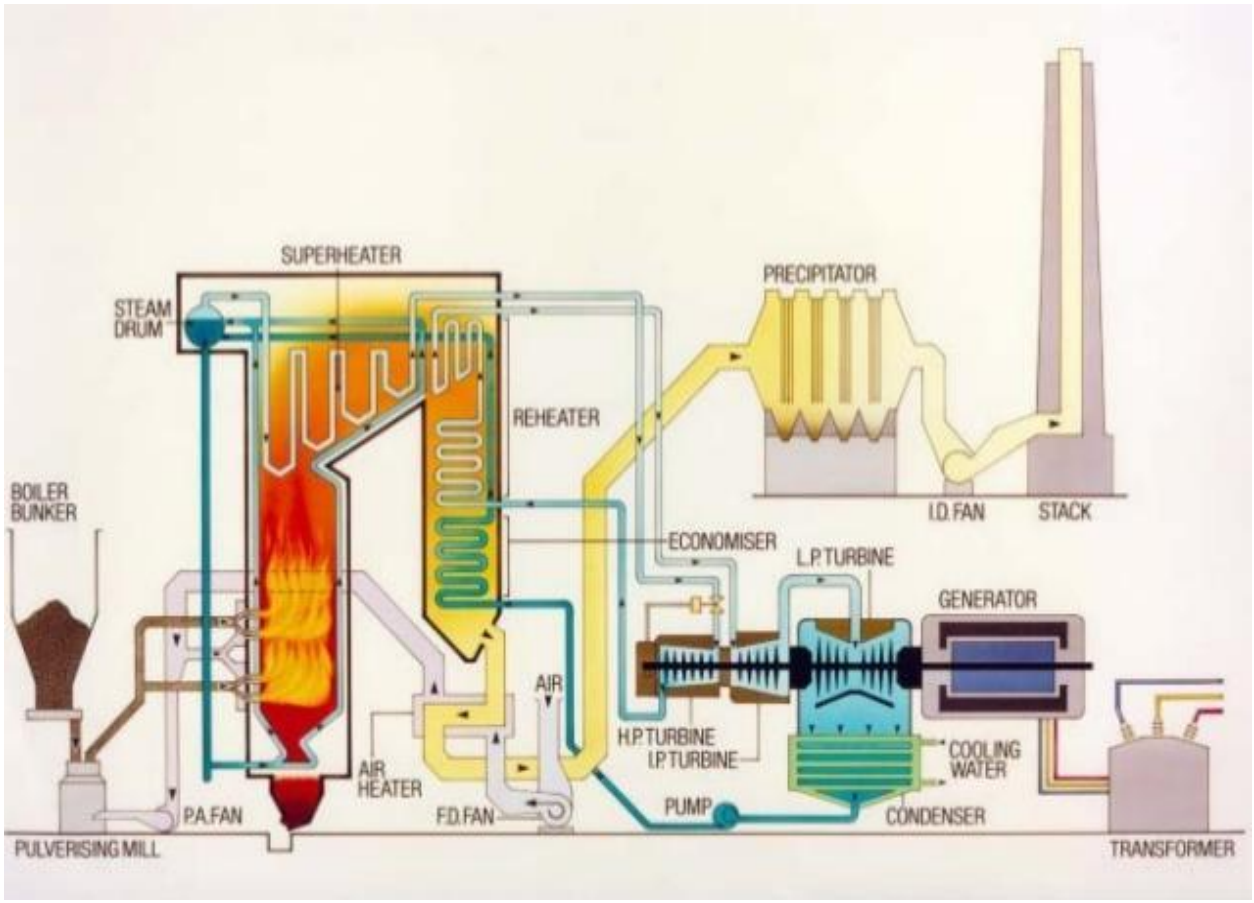
The steam so produced is used in driving the steam turbines which is coupled to generators and thus the Electrical Energy is developed.

1) Coal is conveyed with the help of **Coal Conveyer** from an external stack and ground to a very fine powder by large metal spheres in the **pulverized fuel mill**.
2) There it is mixed with **preheated air** driven by the **Forced draught fan.**
3) The hot air-fuel mixture is forced at High pressure into the Boiler where it rapidly ignites.

4) Water of a high purity flows vertically up the tube-lined walls of the **boiler, where it turns into steam**, and is passed to the boiler drum, where steam is separated from any remaining water.
5) The steam passes through a manifold in the roof of the drum into the pendant **Super heater** where its temperature and pressure increase rapidly to around **200 bar and 570°C**, sufficient to make the tube walls glow a dull red.
6) The **steam is piped to the High-pressure turbine**, the first of a three-stage turbine process.

7) A Steam governor valve allows for both manual control of the turbine and automatic set point following.
8) The steam is exhausted from the high-pressure turbine, and reduced in both pressure and temperature, and **steam is returned to the boiler Reheater**.
9) The **reheated steam** is then passed to the **Intermediate pressure turbine**, and from there passed directly to the **low pressure turbine set.**

10) The exiting steam, now a little above its boiling point, is brought into thermal contact with cold water (pumped in from the cooling tower) in the **Condenser, where steam condenses rapidly back into water,** creating near vacuum-like conditions inside the condenser chest.
11) **The condensed water is then passed by a feed pump through a Deaerator**, and pre-warmed, first in **a feed water heater** powered by steam drawn from the high pressure set, and then in the **Economizer,** before being returned to the boiler drum.


SUPERHEATER
STEAM DRUM
REHEATER
PRECIPITATOR
I.D. FAN
STACK
BOILER BUNKER
ECONOMISER
L.P. TURBINE
GENERATOR
AIR
H.P. TURBINE
I.P. TURBINE
COOLING WATER
AIR HEATER
P.A. FAN
F.D. FAN
PUMP
CONDENSER
PULVERISING MILL
TRANSFORMER

ECONOMISER

Economizer mainly consists of closely spaced parallel tubes through which feed water on its way to boiler flows and the flue gases flows outside the tubes.

Some of the heat energy of the flue gases is recovered by **heating the feed water**, but water is not converted into steam .

This use of economizer results in **saving coal consumption and higher boiler efficiency.**

Advantages of Economiser:

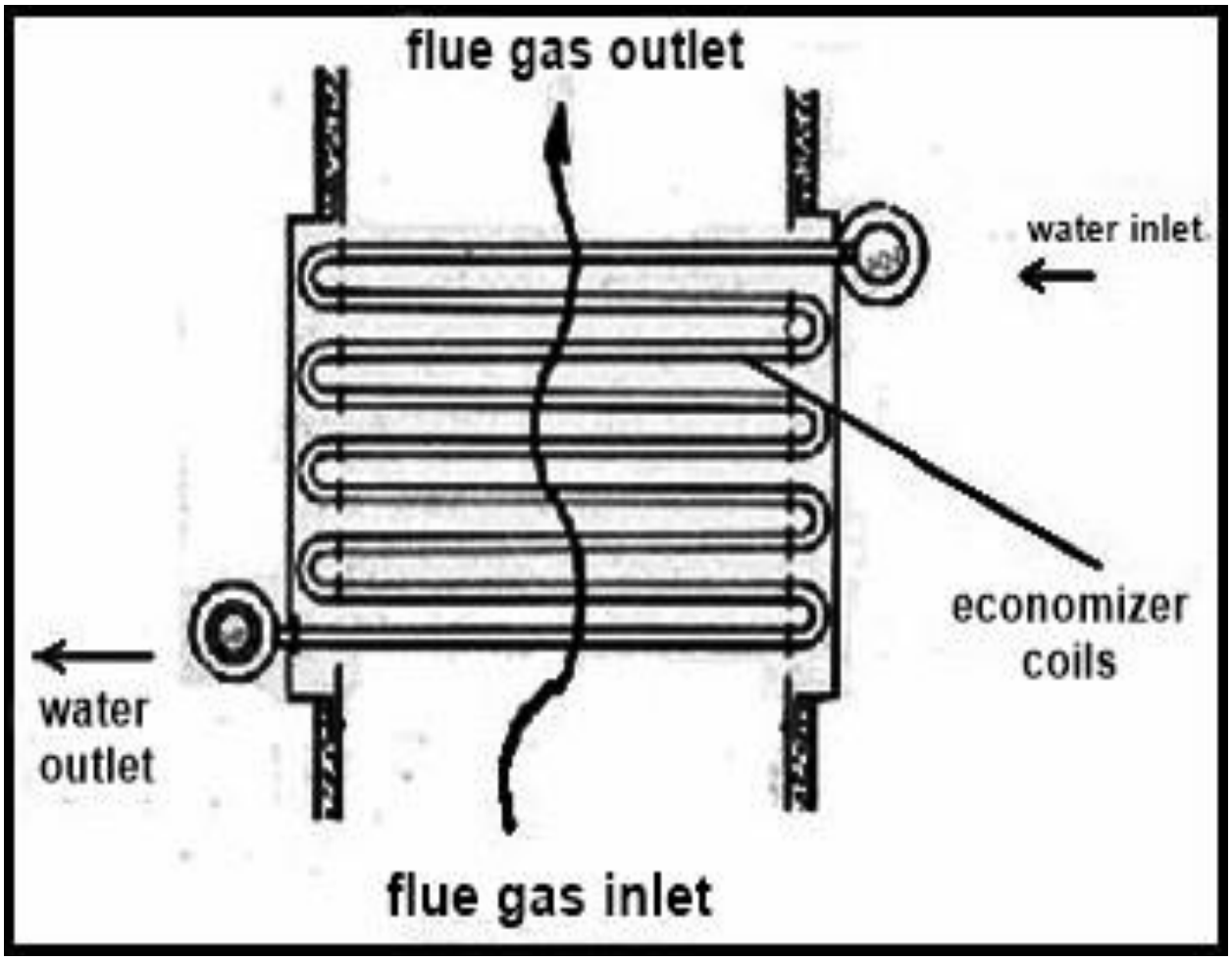
1) **Fuel economy**: – used to save fuel and increase overall efficiency of boiler plant.

2) **Reducing size of boiler**: – As the feed water is preheated in the economizer and enter boiler tube at elevated temperature. The heat transfer area required for evaporation reduced considerably

Disadvantages of Economiser:

1. It needs extra investment

2. It increases maintenance cost and floor area


flue gas outlet
water inlet
economizer
coils
water
outlet
flue gas inlet

SUPERHEATERS

A super heater is a device which raises the temperature of the steam much above the boiling point of water.

The function of the superheater in the thermal power plant is to **remove the last traces of moisture** (1 to 2%) from the saturated steam coming out of boiler and to increase its temperature sufficiently above saturation temperature.

The super-heating **raises overall efficiency** as well as avoids too much condensation in the last stages of the turbine which **avoids the blade erosion.**

The heat of flue gases from furnace is utilized for the removal of moisture from steam and to superheat the steam.

Super heater is placed between boiler and turbine.

The steam is superheated by transferring the heat of gases either by **convection or by radiation** or by combined convection and radiation.

Types of super heaters:

1. **Convective super heater**

2. **Radiant super heater**

Benefits:

- It increases the overall efficiency
- It removes moisture from the saturated steam
- It eliminates the erosion of steam turbine blades due to the absence of moisture

REHEATERS

Some of the heat of superheated steam is used to rotate the turbine where it loses some of its energy.

The same exhaust steam after reheating is used to rotate the second steam turbine where the **heat is converted to mechanical energy.**

This mechanical energy is used to run the alternator, which is coupled to turbine, there by generating electrical energy.

AIR PREHEATER

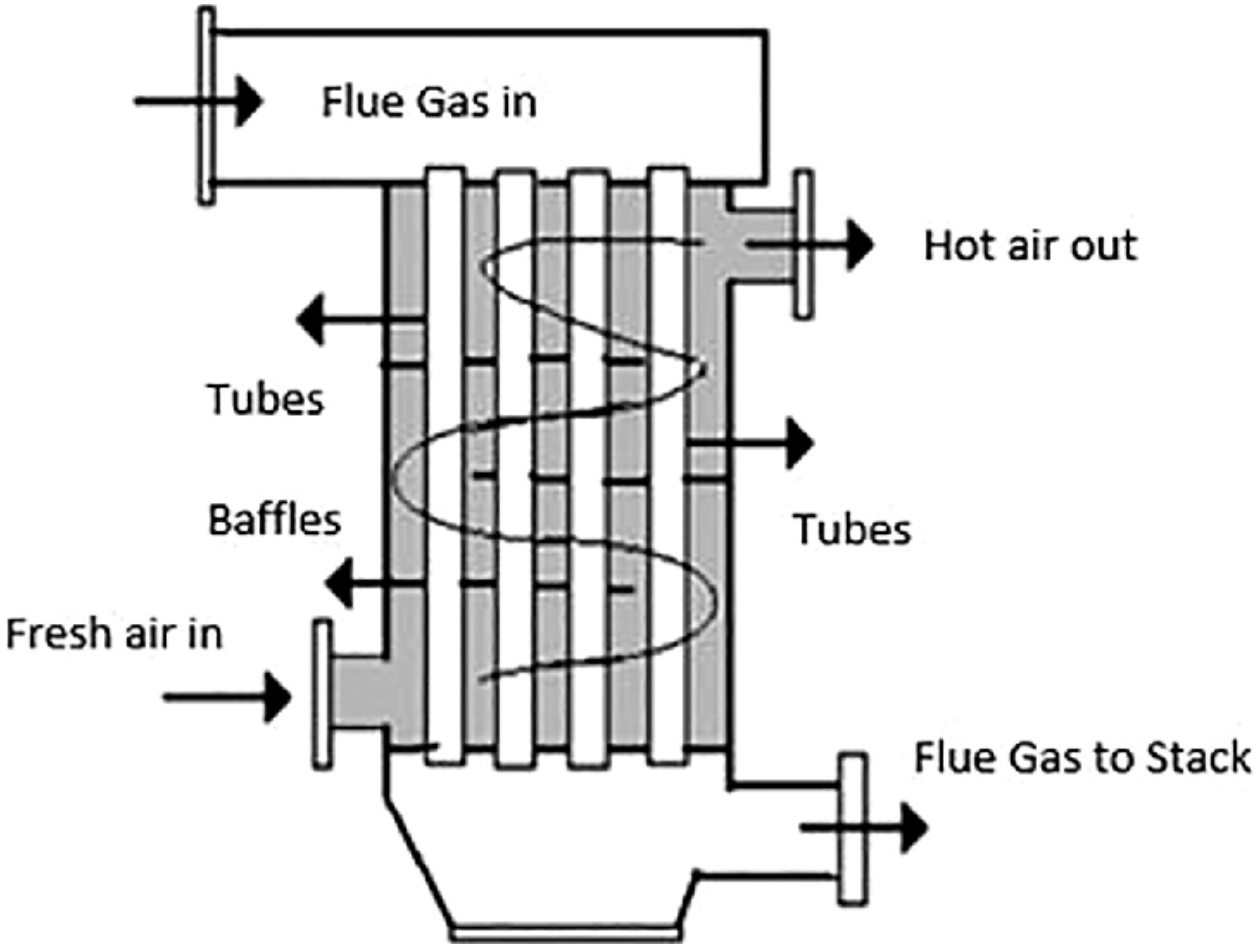
It is used to **preheat the air** before entering into furnace. The remaining heat of flue gases coming out of economiser is utilized by air preheater.

It is a device used to transfer heat from the flue gases to the air, before the air enters the furnace. Air preheaters are placed in between economizer and chimney.

An air preheater increases the temperature of the air supplied for coal burning by deriving heat from flue gases.

- Air is drawn from the atmosphere by a forced draught fan and is passed through air preheater before supplying to the boiler furnace.

- The air preheater extracts heat from flue gases and increases the temperature of air used for coal combustion.



BOILER

Definition of Boiler

Steam boiler or simply a boiler is basically a closed vessel into which water is heated until the water is converted into steam at required pressure.

The boiler is essentially a closed vessel inside which water is stored.

Working Principle of Boiler

Fuel (generally coal) is burnt in a furnace and hot gasses are produced. These hot gasses come in contact with water vessel where the heat of these hot gases transfer to the water and consequently steam is produced in the boiler. Then this steam is passed to the turbine of thermal plant.

Types of Boiler

1. Fire tube boiler and
2. Water tube boiler

Fire Tube Boiler

In fire tube boiler, there are number of tubes through which hot gases are passed and water surrounds these tubes.

Water tube boiler is reverse of the fire tube boiler. In water tube boiler the water is heated inside tubes and hot gasses surround these tubes.

Operation of Fire Tube Boiler

Operation of fire tube boiler is as simple as its construction. In fire tube boiler, the fuel is burnt inside a furnace.

The hot gases produced in the furnace then passes through the fire tubes. The fire tubes are immersed in water inside the main vessel of the boiler.

As the hot gases are passed through these tubes, the heat energy of the gasses is transferred to the water surrounds them. As a result steam is generated in the water and naturally comes up.

This steam is then taken out from the steam outlet for utilizing for required purpose. The water is fed into the boiler through the feed water inlet.

As the steam and water is stored is the same vessel, it is quite difficult to produce very high pressure steam. General maximum capacity of this type of boiler is **17.5 kg/cm2 and with a capacity of 9 Metric Ton of steam per hour.**

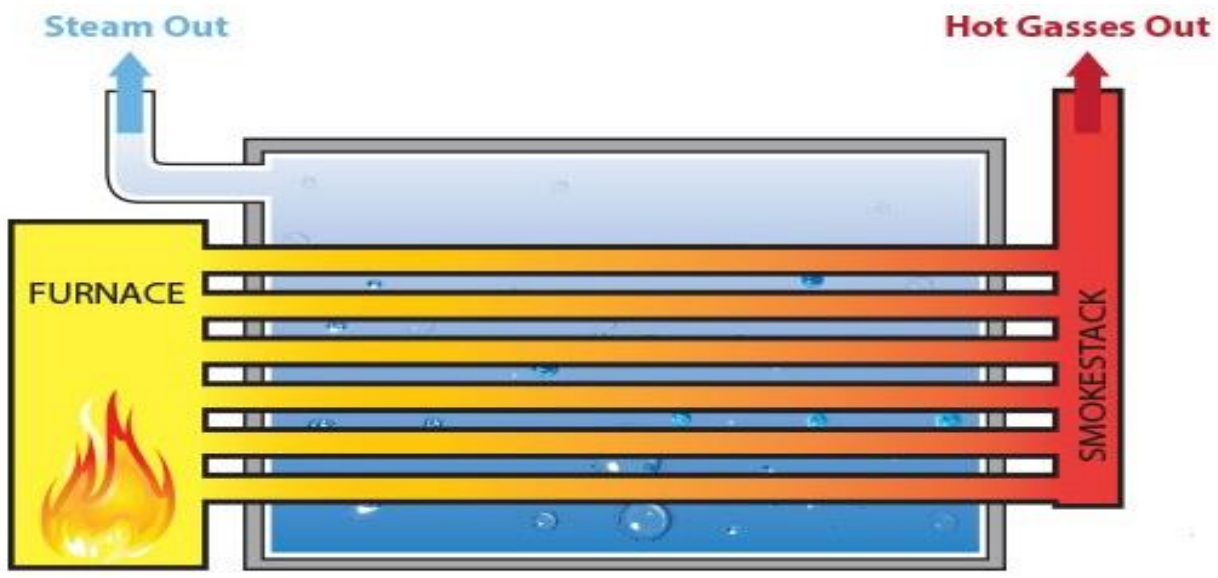


Figure: Fire Tube Boiler

Advantages of Fire Tube Boiler

- It is quite **compact in construction.**
- Fluctuation of **steam demand can be met** easily.
- **Cheaper** than water tube boiler.

Disadvantages of Fire Tube Boiler

- Due to large water the required **steam pressure rising time is quite high.**
- **Output steam pressure cannot be very high** since the water and steam are kept in same vessel.
- The **steam** received from fire tube **boiler is not very dry.**
- In a fire tube boiler, the steam drum is always under pressure, so there may be a **chance of huge explosion** which resulting to severe accident.

Water Tube Boiler

- A water tube boiler is such kind of boiler where the water is heated inside tubes and the hot gasses surround them. This is the basic definition of water tube boiler. Actually this boiler is just opposite of fire tube boiler where hot gases are passed through tubes which are surrounded by water.
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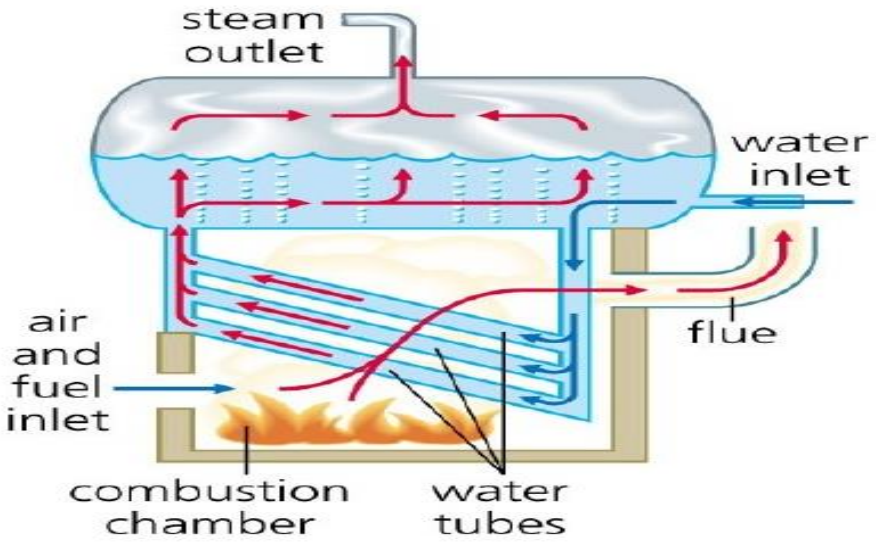


Types of Water Tube Boiler

There are many types of water tube boilers, such as

- Horizontal Straight Tube Boiler.
- Bent Tube Boiler.

Advantages of Water Tube Boiler

There are many advantages of water tube boiler due to which these types of boiler are essentially used in large thermal power plant.

- **Larger heating surface** can be achieved by using more numbers of water tubes.
- Due to convectional flow, movement of water is much faster than that of fire tube boiler, hence **rate of heat transfer is high** which results into higher efficiency.
- **Very high pressure** in order of **140 kg/cm^2** can be obtained smoothly.

Disadvantages of Water Tube Boiler

- The main disadvantage of water tube boiler is that it is **not compact in construction**.
- Its cost is **not cheap.**

Size is a **difficult for transportation** and construction

CONDENSER

Condenser is a device in which **steam is condensed to water at a pressure below atmospheric pressure.**

Steam, after expansion through the prime mover, goes through the condenser which condenses the exhaust steam and also removes air and other non-condensable gases from steam while passing through them.

Functions of condenser

- **To reduce the turbine exhaust pressure** so as to increase the specific output and hence increase the plant efficiency.
- To condense the exhaust steam from the turbine and **re use it as pure feed water** in the boiler.
- Enables **removal of air and other non condensable gases from steam**. Hence improved heat transfer.

Types of Steam Condenser

Depending upon condensation techniques, there are mainly two types of steam condensers. They are mainly

1. **Jet Steam Condenser.**

2. Surface Steam Condenser.

Jet Steam Condenser

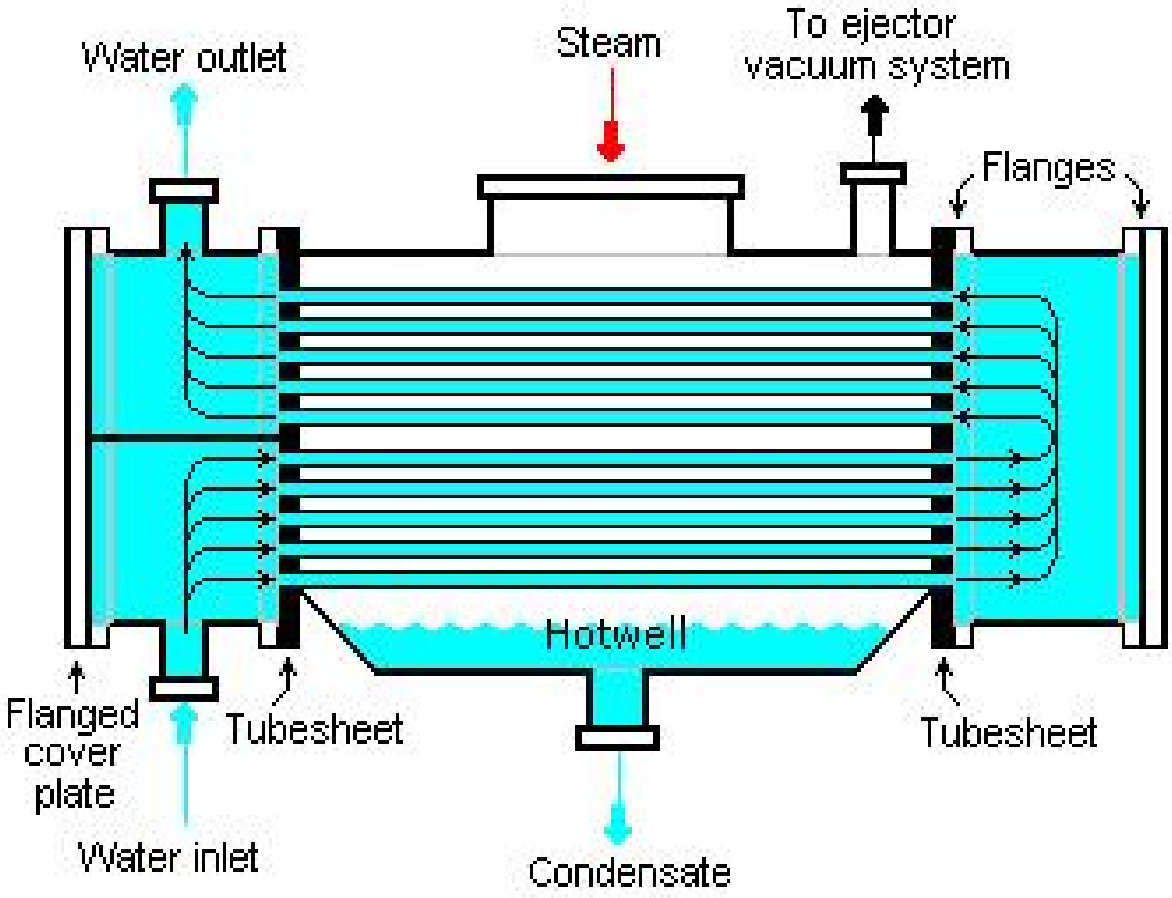
Here cooling water is sprayed on the exhaust steam. This is very fast process of condensing steam. But here **cooling water and condensed steam are mixed up** which can not be separated.

Surface Steam Condenser

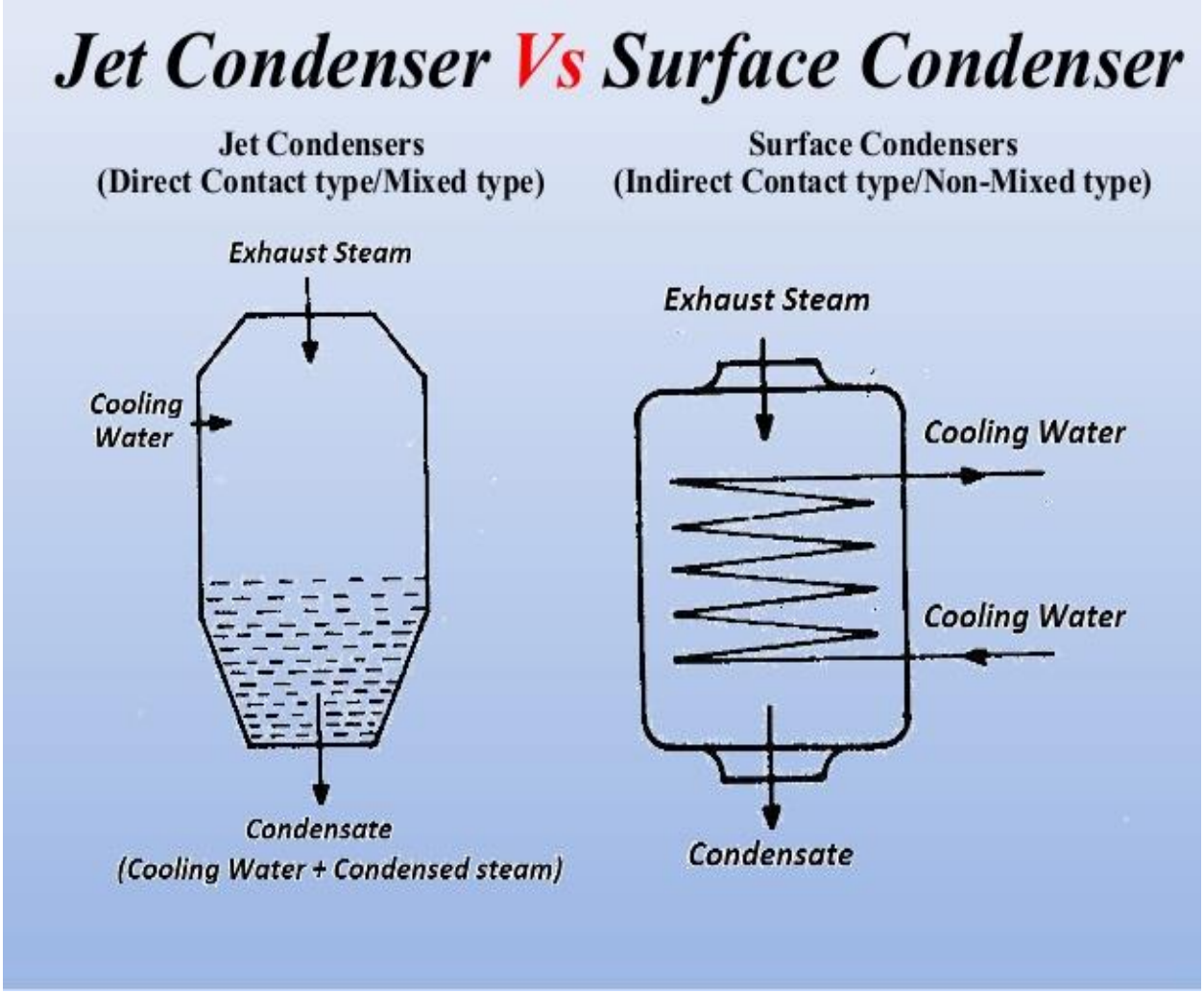
Here, cooling water and exhaust steam are separated by a **barrier** and condensation is done by heat exchanging through this barrier wall.

Cooling water is passed through numbers of water tubes and exhaust steam passes over the outer surface of the tube.

The heat of steam is absorbed by the water inside the tube.



SURFACE CONDENSER



STEAM TURBINE

A steam turbine is used as prime mover to generator. A steam turbine converts **heat energy of steam into mechanical energy a**nd drives the generator.

It uses the principle that steam when issuing from a small opening attains a high velocity. This velocity attained during expansion depends on the initial and final heat content of the steam. This difference *b/w* initial and final heat content represents the heat energy converted into kinetic energy.

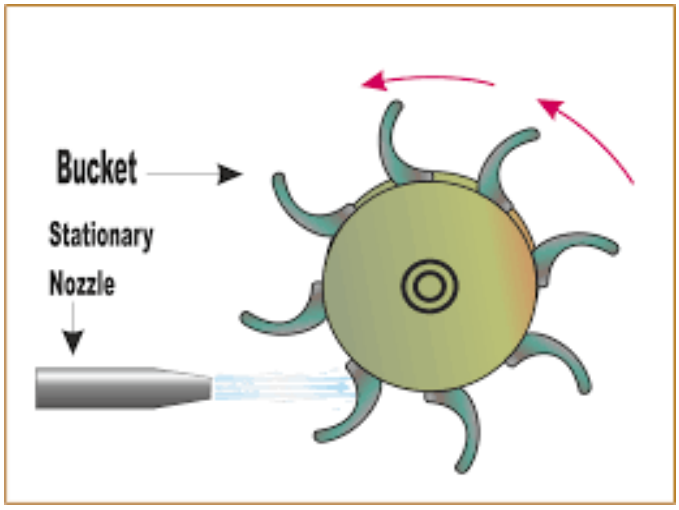
These are of two types:

1. **Impulse Turbine**
2. **Reaction Turbine**

Impulse turbines:

In principle, the **impulse** steam **turbine** consists stationary steam nozzles and a rotor with moving or rotating buckets or blades.
The steam passes through the stationary nozzles and is directed at high velocity to the rotor buckets.
The rotor buckets starts to rotate at high speed.

i.e. in impulse turbine, pressure energy of steam is converted into kinetic energy



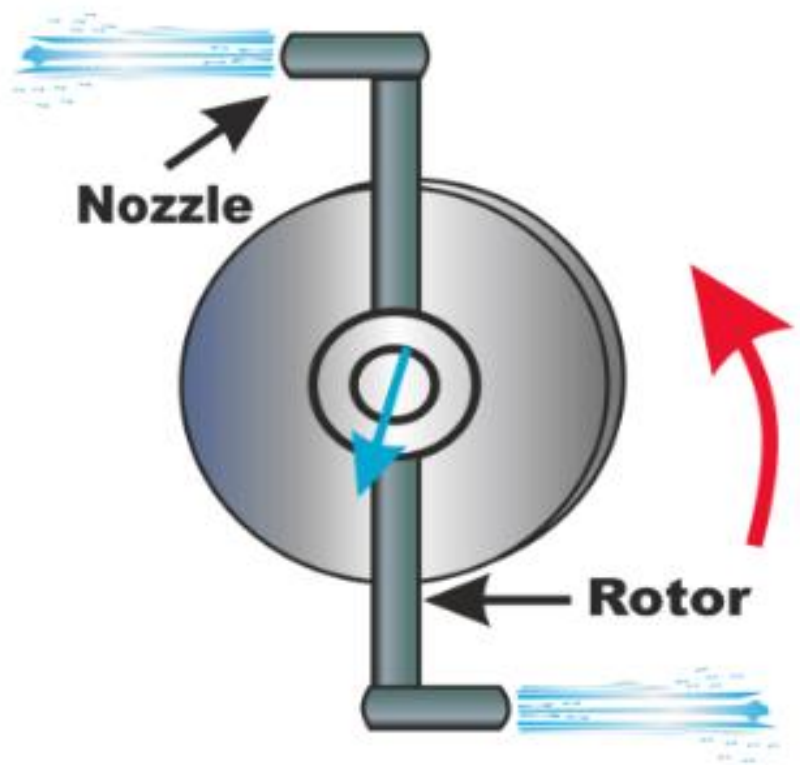
Reaction turbines:

A reaction turbine is a type of turbine that develops torque by reacting to the pressure or weight of the steam.

In a reaction turbine, unlike in an impulse turbine, the nozzles that discharge the steam are attached to the rotor.

The acceleration of the steam leaving the nozzles produces a reaction force, causing the rotor to move in the opposite direction to that of the steam.

The pressure of the steam changes as it passes through the rotor blades.



Reaction turbine speed is much lower than impulse turbine
because steam velocity is lower in reaction turbine as compared to impulse turbine.

Impulse Turbine	Reaction Turbine
1) In impulse Turbine, only impulsive force strikes to the blades fixed to the rotor	1) In reaction turbine, vector sum of impulsive and reactive force strikes the blades fixed to the rotor.
2) Steam expands completely when it passes through the nozzles and its pressure remains constant.	2) Pressure can't expand fully. It partially expands when it pass through the nozzles and rest on the rotor blades.
3) Blades are symmetrical shape.	3) Blades are asymmetrical shape.
4) Since the velocity of steam is high, speed is high in impulse turbine.	4) Reaction turbine speed is much lower than impulse turbine because steam velocity is lower in reaction turbine as compared to impulse turbine.
5) For producing same power, the number of stages required is much less.	5) It requires more stages to develop same power.
6) The blade efficiency curve is high.	6) The blade efficiency curve is lower than impulse turbine.

COOLING TOWERS

- In order to improve the efficiency of the plant, the steam exhausted from the turbine is condensed by means of a condenser
- Water is drawn from a natural source of supply such as a river, canal or lake and is circulated through the condenser
- The circulating water takes up the heat of the exhausted steam and itself becomes hot. This hot water coming out from the condenser is discharged at a suitable location down the river
- During the scarcity of water in the river, hot water from the condenser is passed on to the cooling towers where it is cooled. The cold water from the cooling tower is reused in the condenser

Cooling tower- or building-like device in which atmospheric air (the heat receiver) circulates in direct or indirect contact with warmer water (the heat source) and the water is thereby cooled.

Most of the plants use closed cooling systems where warm water coming from condenser is cooled and re used.

- Small plants use spray ponds and medium and large plants use cooling towers.
- Cooling tower is a steel or concrete hyperbolic structure having a reservoir at the base for storage of cooled water
- Height of the cooling tower may be 150 m or so and diameter at the base is 150 m.

The cooling tower is a semi-enclosed device for cooling of water by contact with air. The hot water coming out from the condenser is fed to the tower. The air flows from bottom of the tower or perpendicular to the direction of water flow and then exhausts to the atmosphere after effective cooling.

Types of cooling towers:

1. Natural Draught cooling tower
2. Forced Draught cooling tower
3. Induced Draught cooling tower
4. Balanced Draught cooling tower

ELECTROSTATIC PRECIPITATOR

The use of Electrostatic precipitator is to **remove fine dust particles from flue gas.**

It is placed between combustion chamber and chimney.

Working Principle:

Electrostatic precipitators work by forcing dirty flue gas past two electrodes which take the form of metal wires, bars, or plates.

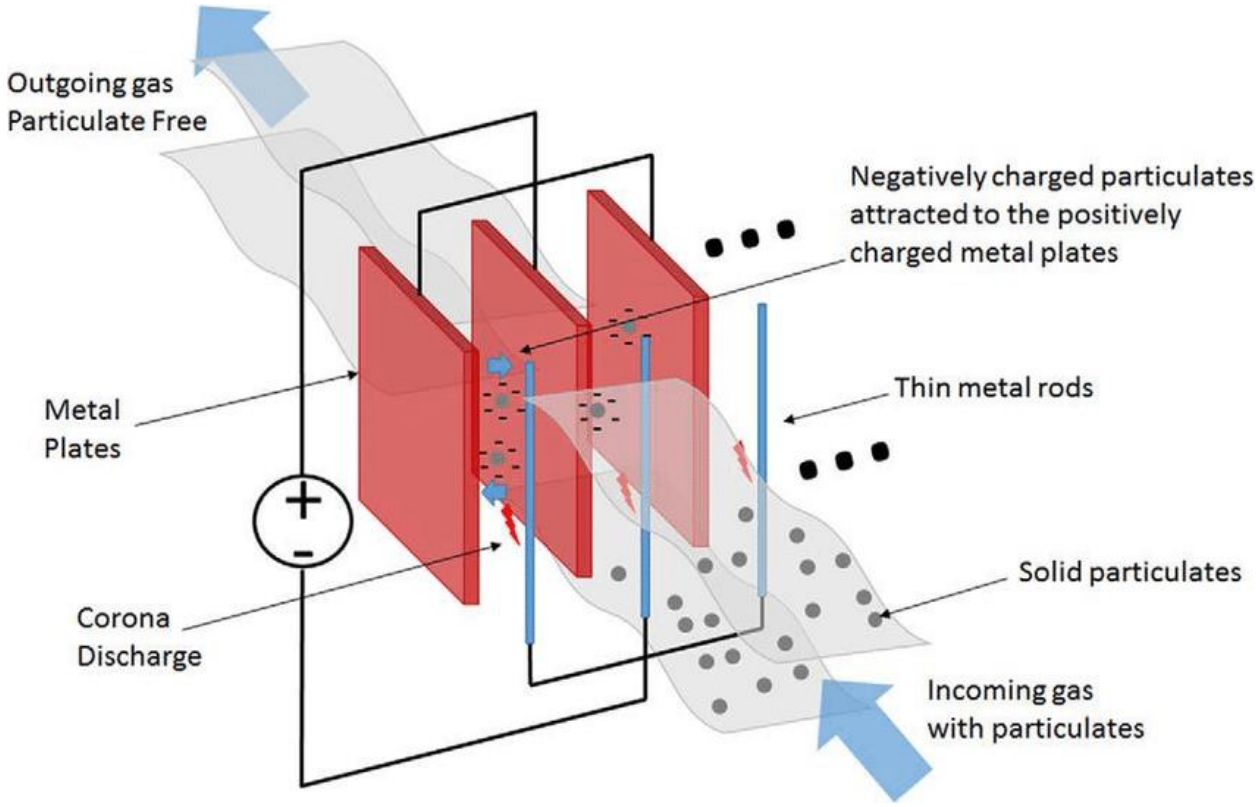
First electrode is charged to a very high negative voltage.

As the dirt particles move past it, they pick up a negative charge.

Second electrode charged to a high positive voltage .

Since unlike charges attract the negatively charged dirt particles are attracted to the positively charged plates and stick there.

From time to time, the collecting plates have to be shaken to empty away the dust; that can be done either manually (by someone brushing them clean) or automatically (by some kind of automated shaking or brushing mechanism in a process called rapping).



Advantages of Electrostatic Precipitator

- This is more effective to remove very small particles like **smoke, mist and fly ash.**
- Its efficiency is as high as **99.5%**
- The **maintenance charges are less** compared to all other separators.
- Operation is **easy.**
- The dust is collected in dry form and can be removed either dry or wet.

Disadvantages of Electrostatic Precipitator

- It requires high voltage DC supply (**20KV-100KV)**.
- The space required is larger as compared to wet system.
- The **running charge**s are also considerably **high** as the amount of power required for charging is considerably large.
- **Sparking may occur** between the plates because the spacing is less.

CHIMNEY (STACK)

Chimneys are used to **exhaust waste dust gases i.e. flue gases.**

Chimneys are typically vertical, to ensure that the gases flow smoothly.

Chimneys are made up of steel (or) bricks and concrete. Concrete chimneys are more popular. The average life of concrete chimneys is 50 years and that of steel chimneys are about 15 years depending upon the care taken to prevent corrosion.

The net area of chimney depends on the following factors.

- Volume of gases to be discharged when the boilers operate at maximum rating.
- Temperature of flue gas at entry point.
- Exit velocity.
- Composition of flue gas.

FAN OR DRAUGHT SYSTEM

In boiler it is essential to supply a controlled amount of air to the furnace for effective combustion of fuel and to evacuate hot gases formed in the furnace through the various heat transfer area of the boiler. This can be done by using a chimney or mechanical device such as fans which acts as pump.

1.Forced draught system
2. Induced draught system
3. Balanced draught system

THERMAL POWER PLANTS IN INDIA				
S.No	Plant & Commissioned Date	Location	Capacity (MW)	Operator
1	Vindhyachal Thermal Power Station (1987)	Singrauli, Madhya Pradesh	4,760	NTPC(Largest Plant)
2	Mundra Thermal Power Station (May 2009)	Mundra, Kutch district, Gujarat	4,620	Adani Power(Largest private power company)
3	Mundra Ultra Mega Power Plant (March 2009)	Mundra Ultra Mega Power Plant (March 2009) Mundra, Kutch district, Gujarat	4,000	Gujarat Power Limited (CGPL), a subsidiary of Tata Power
4	Talcher Super Thermal Power Station (Feb 1995)	Angul district, Odisha	3,000	NTPC
5	Sipat Super Thermal Power Station or Rajiv Gandhi Super Thermal Power Station (Aug 2008)	Sipat, Bilaspur district, Chhattisgarh	2,980	NTPC
6	NTPC Dadri (Oct 1991)	Dadri, Gautam Budh Nagar district, Uttar Pradesh	2,637	NTPC

S.No	Plant & Commissioned Date	Location	Capacity (MW)	Operator
7	NTPC Ramagundam (Nov 1983)	Ramagundam Peddapalli district, Telangana	2,600	NTPC
8	Korba Super Thermal Power Plant (March 1983)	Jamnipali, Korba district, Chhattisgarh	2,600	NTPC
9	Rihand Thermal Power Station	Renukut, Sonbhadra district, Uttar Pradesh	2,500	NTPC
10	Sterlite Jharsuguda Power Station (Aug 2010)	Jharsuguda, Jharsuguda district, Odisha	2,400	Sterlite Energy, a subsidiary of Vedanta Resources
11	Simhadri Super Thermal Power Station (Feb 2002)	Visakhapatnam, Andhra Pradesh	2,000	NTPC(First coastal coal fired TPS)
12	Singrauli Super Thermal Power Station (Feb 1982)	Shaktinagar, Sonebhadra district, Uttar Pradesh	2,000	NTPC
13	Sri Damodaram Sanjeevaiah Thermal Power Station (March 2014)	Krishnapatnam, Nellore district, Andhra Pradesh	1600 (Two 800MW units)	Joint Venture of APGENCO (50%) & IL & FS(50%)