

POWER PLANT ENGINEERING

STEAM POWER PLANT



HAVE YOU SEEN IT SOMEWHERE?





INTRODUCTION

- ❖ A Thermal Power Plant converts the heat energy of coal into electrical energy.
- ❖ The expansion of steam in turbine produces mechanical power which drives the alternator coupled to the turbine.
- ❖ Thermal Power Plants constitute 75.43% of the total installed captive and non-captive power generation in India .



THERMAL POWER PLANT

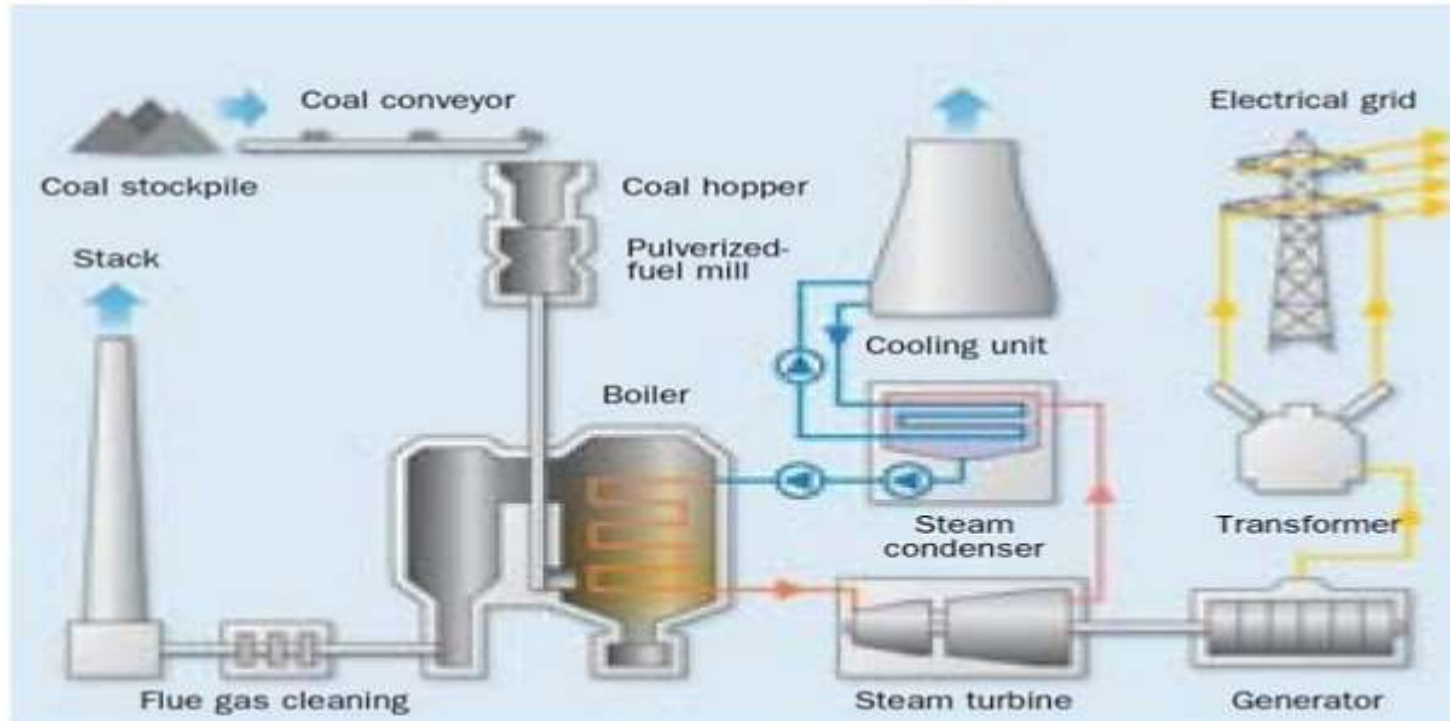
A thermal power station is known as power plant in which the prime mover is steam drive. Water is made to enter into the system and then heated, later which turns into the steam.

The basic components of the thermal power station are

1. Boiler
2. Steam turbine
3. Generator
4. Condenser

THERMAL POWER PLANT

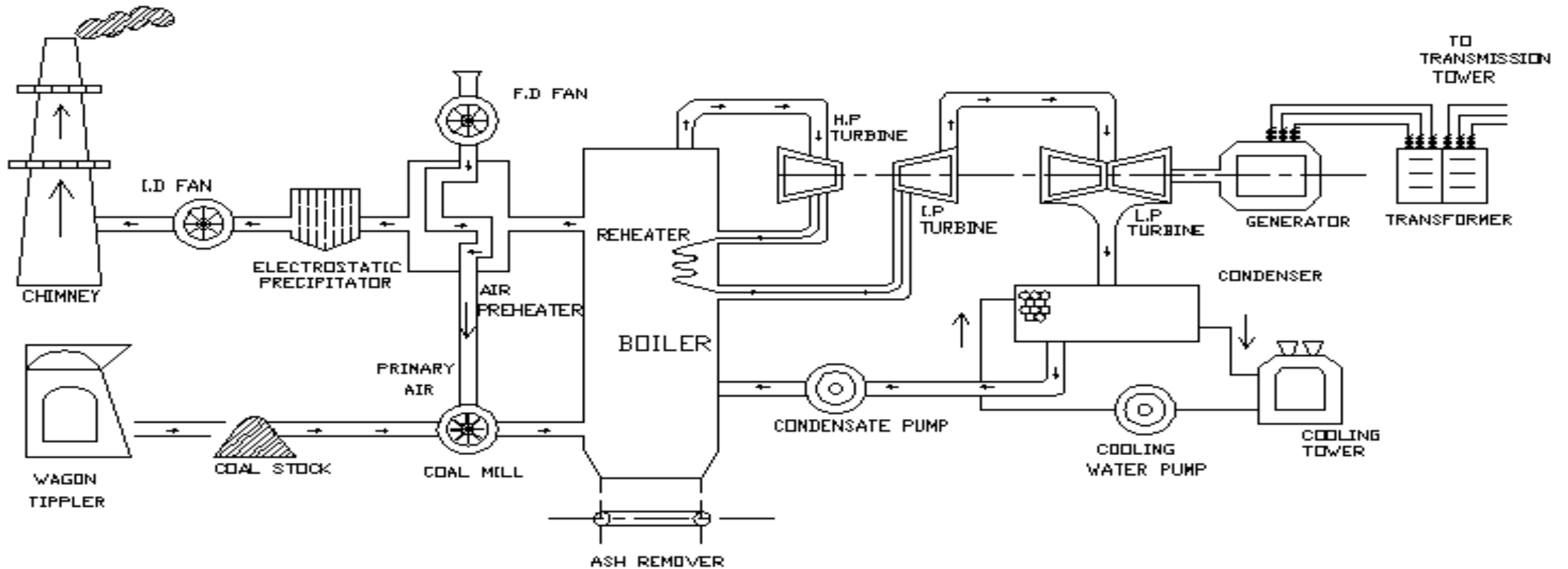
GENERAL LAYOUT OF THERMAL POWER PLANT





PLANT LAYOUT

SCHEMATIC DIAGRAM





FUNCTION HELD IN PLANT

1.COAL FLOW

2.STEAM FLOW

3.WATER FLOW

4.ASH HANDLING





EQUIPMENTS

- ❖ Coal handling plant
- ❖ Pulverizing plant
- ❖ Draft fans
- ❖ Boiler
- ❖ Ash handling plant
- ❖ Turbine
- ❖ Condenser
- ❖ Cooling towers and ponds
- ❖ Feed water heater
- ❖ Economiser
- ❖ Superheater and Reheater
- ❖ Air preheater



Boiler

A boiler is a closed vessel in which the water or fluid is heated

Steam turbine

A steam turbine is a device which extracts thermal energy from the pressurized steam. The energy must be used to organize mechanical work on a rotating output shaft.

Generator

A generator is a device which is used to convert the mechanical form of energy into the electrical energy.

Condenser

A condenser is a device used to convert the gaseous substance into the liquid state substance with the help of cooling.

COAL HANDLING PLANT





PULVERISING PLANT

Pulverizing mills are classified as:

- ❖ Contact mill
- ❖ Ball mill
- ❖ Impact mill





Cooling towers

A cooling tower is a heat rejection device, which discards the waste heat into the atmosphere with help of the cooling water stream to a lower temperature.

Circulating water pump

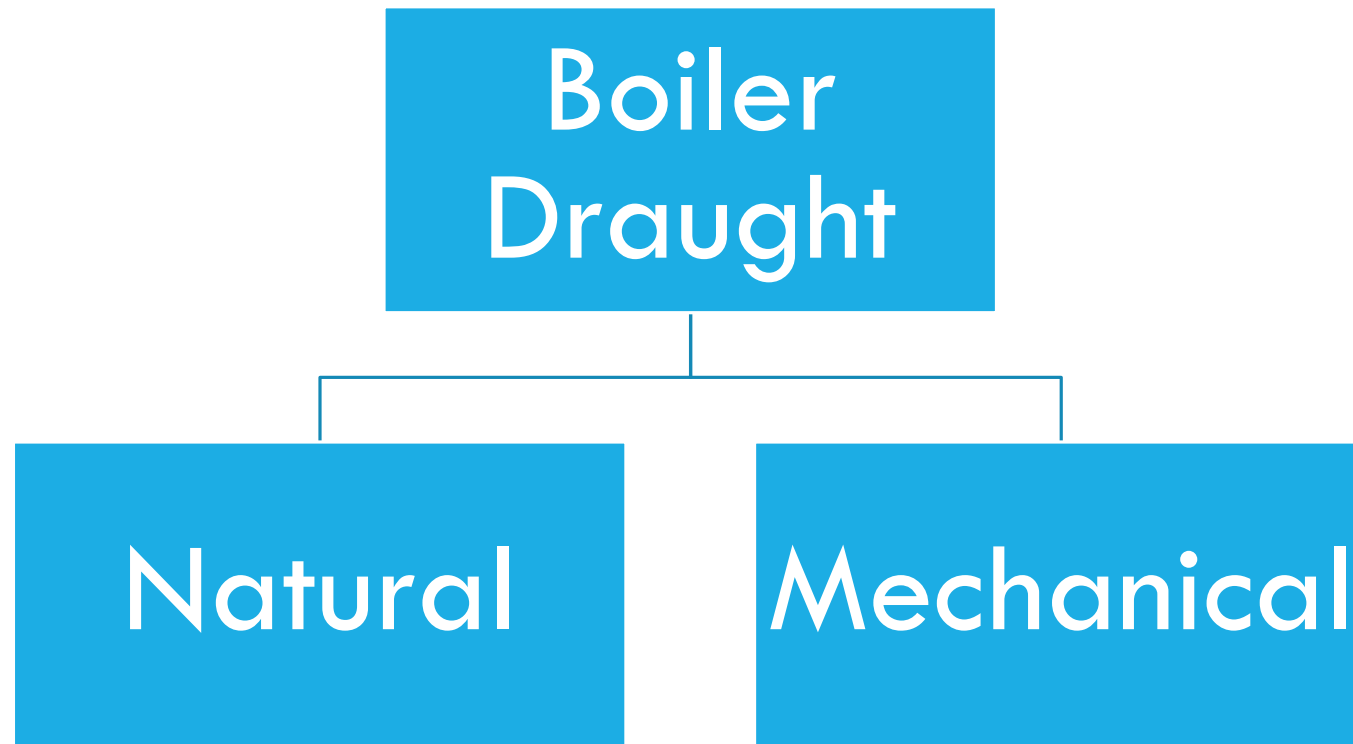
Circulating pump is a special device used to circulate the liquids, gases and slurries present in the closed circuit. The main purpose of the circulating pump is circulating the water in a cooling system or hydronic heating.

Boiler feed pump

A boiler feed pump is a specific type of pump which is used to feed the water into the steam boiler. The condition of water supply depends on the boiler produce the condensation of the steam.



DRAUGHT SYSTEM





Forced draught fans

Forced draught fans are used to provide a positive pressure to a system.

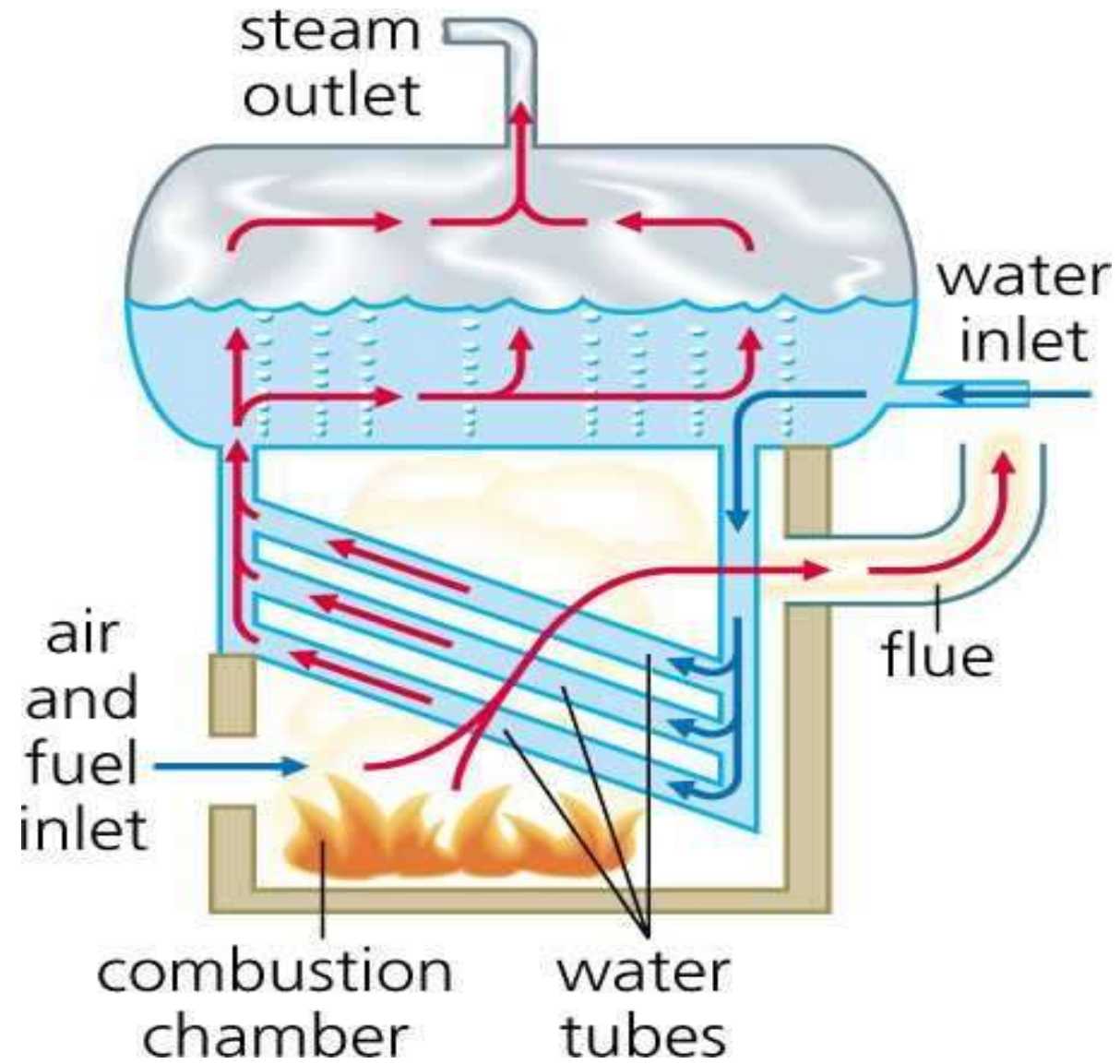
Induced draught fans

Induced draught fans are used to provide a negative pressure or vacuum in a slack or system

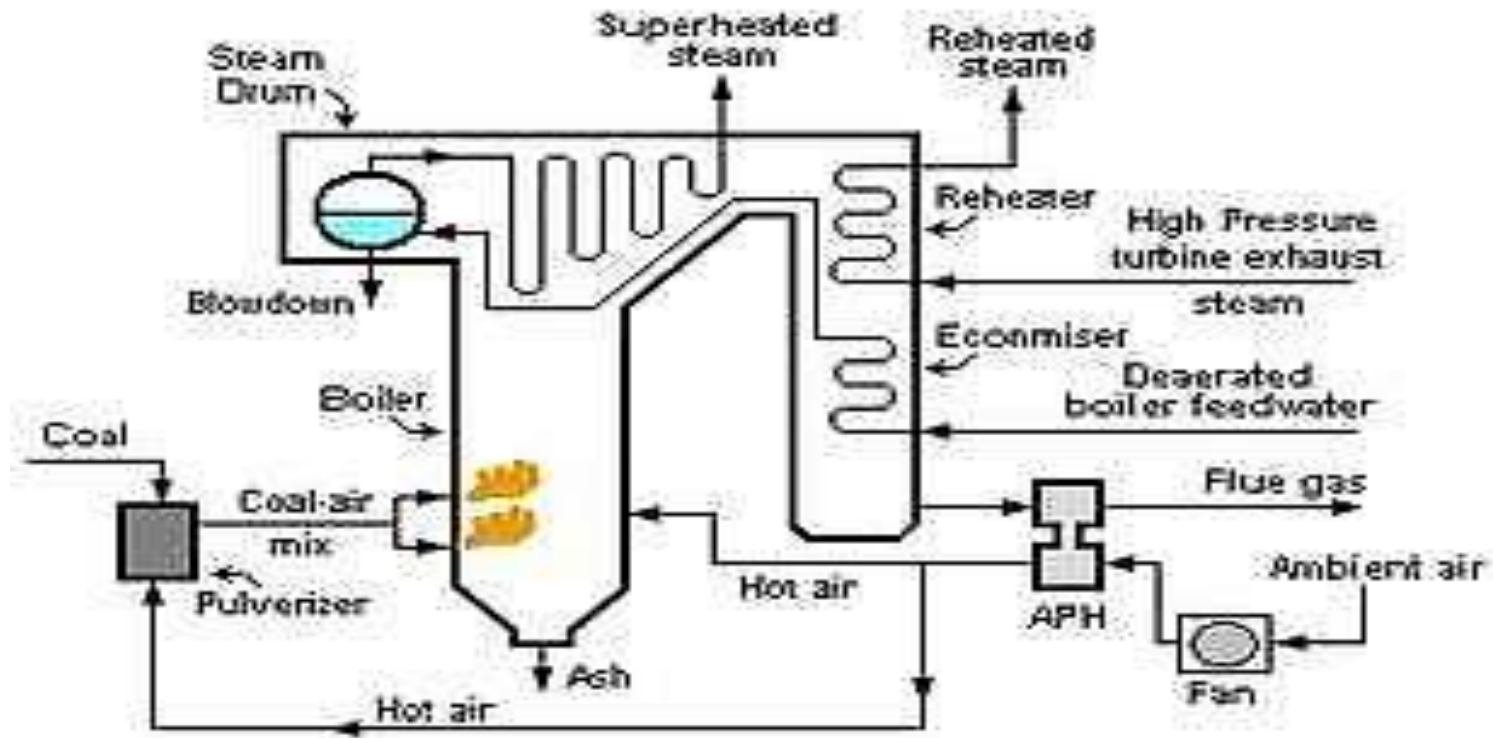
Ash precipitators

Precipitators are devices used to remove the fine particles like smoke and dust. By using the force of induced electrostatic charge minimally close the flow of gases through the unit.

BOILER

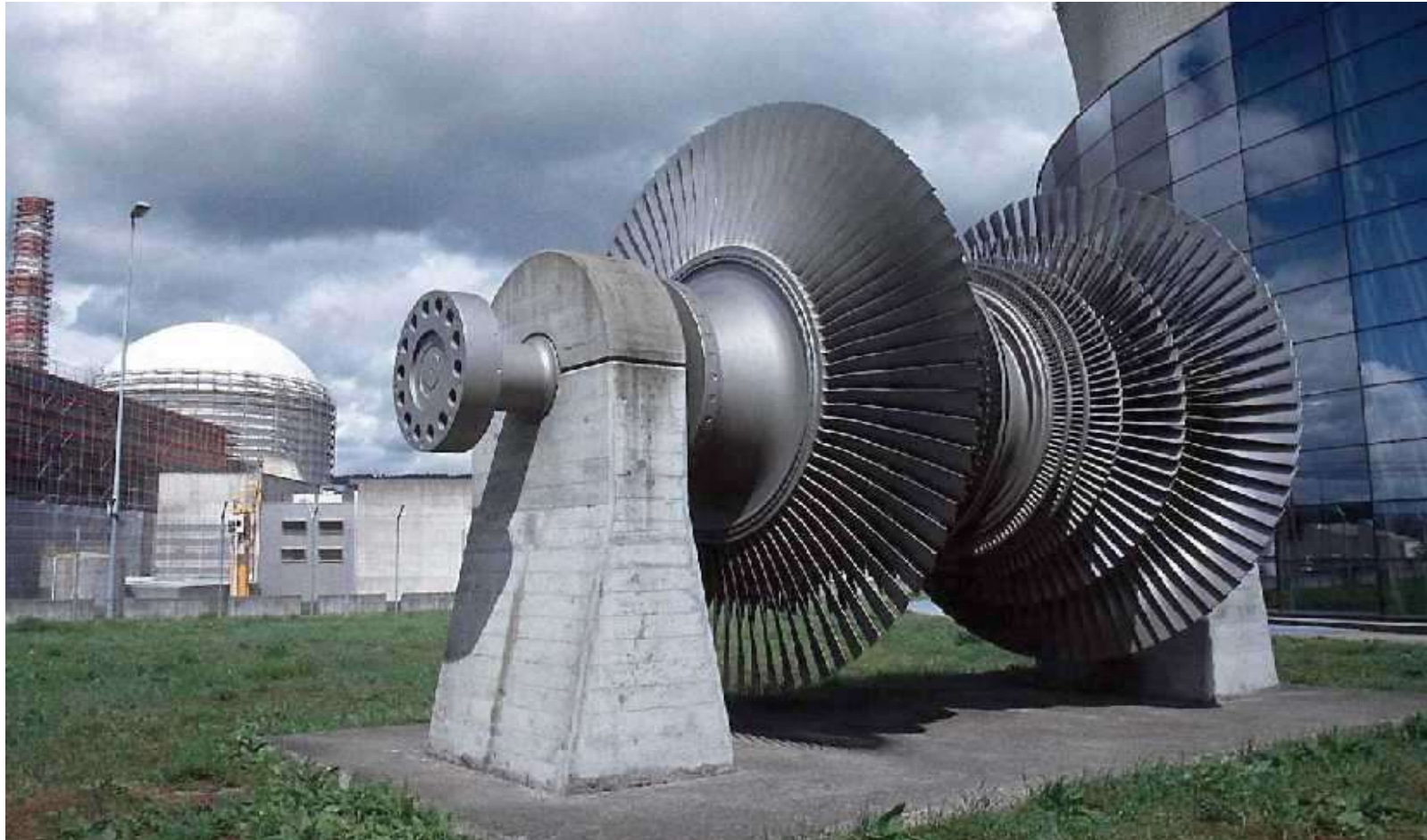


AIR PRE HEATER



Note: APH is the air preheater

TURBINE





WORKING PRINCIPLE OF THERMAL POWER PLANT:

The water is boiled and made into steam.

The steam is kept on heating till it becomes superheated. (A steam can only attain a particular temperature at a particular pressure. Heating it above that temperature but keeping the pressure constant is called superheating the steam)

The superheated steam has a lot of energy and it is allowed to pass through the blades of a turbine

The pressure exerted by the steam on the turbine rotates the turbine. This makes the steam lose its energy and expand as the pressure drops rapidly and volume expands.

The steam, after expanding is cooled down at a constant pressure to water and then pumped back into the boiler for use again.

The turbine which was rotating was coupled with the generator. The generator rotates along with the turbine.

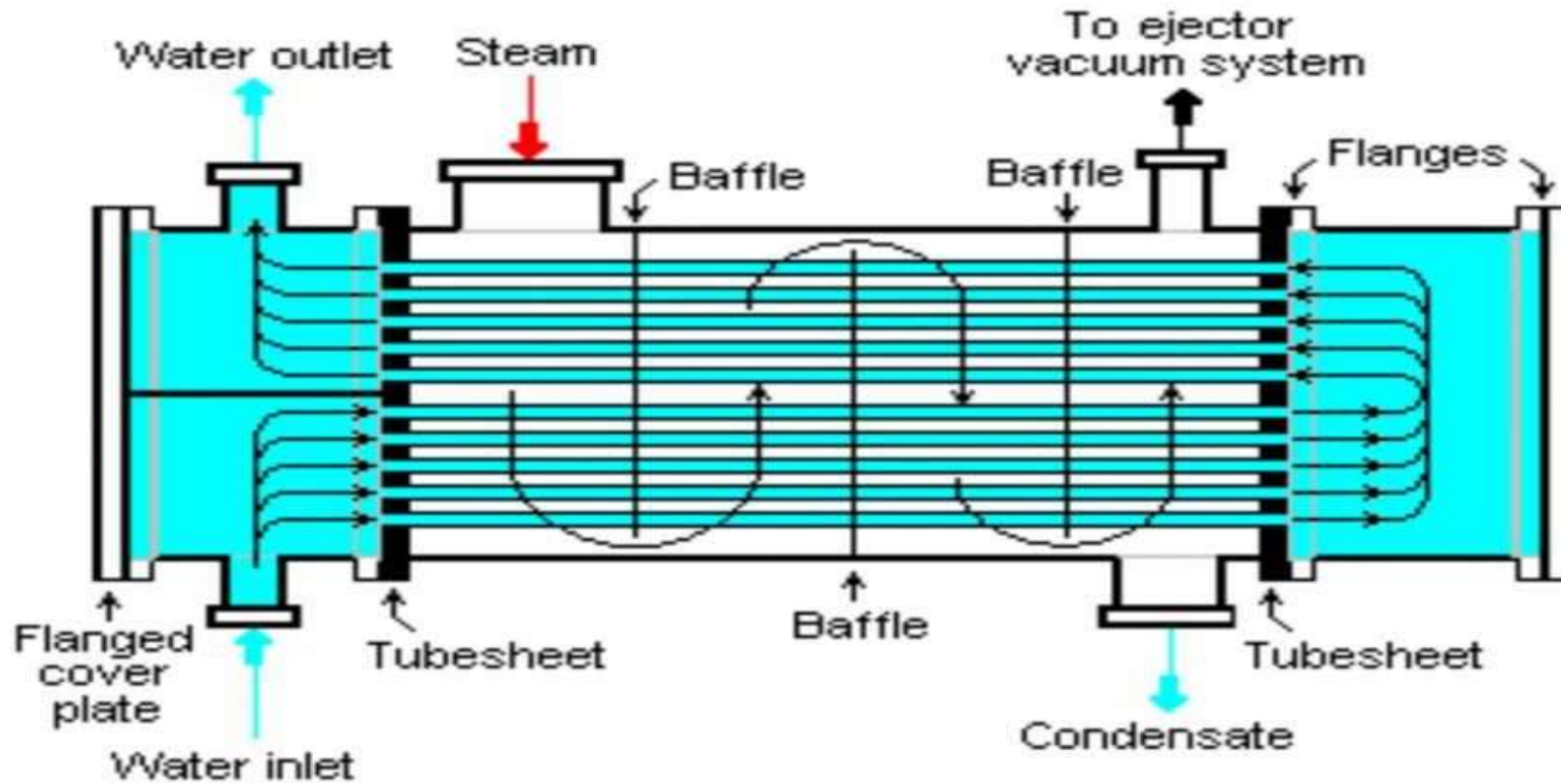


ASH HANDLING PLANT

- ❖ The percentage of ash in coal varies from 5% in good quality coal to about 40% in poor quality coal
- ❖ Power plants generally use poor quality of coal, thus amount of ash produced by it is pretty large
- ❖ A modern 2000MW plant produces about 5000 tons of ash daily



CONDENSER





COOLING TOWER





[How does a Thermal power plant work ? - YouTube](#)

