Chapter – 1
Thermal Power Plant

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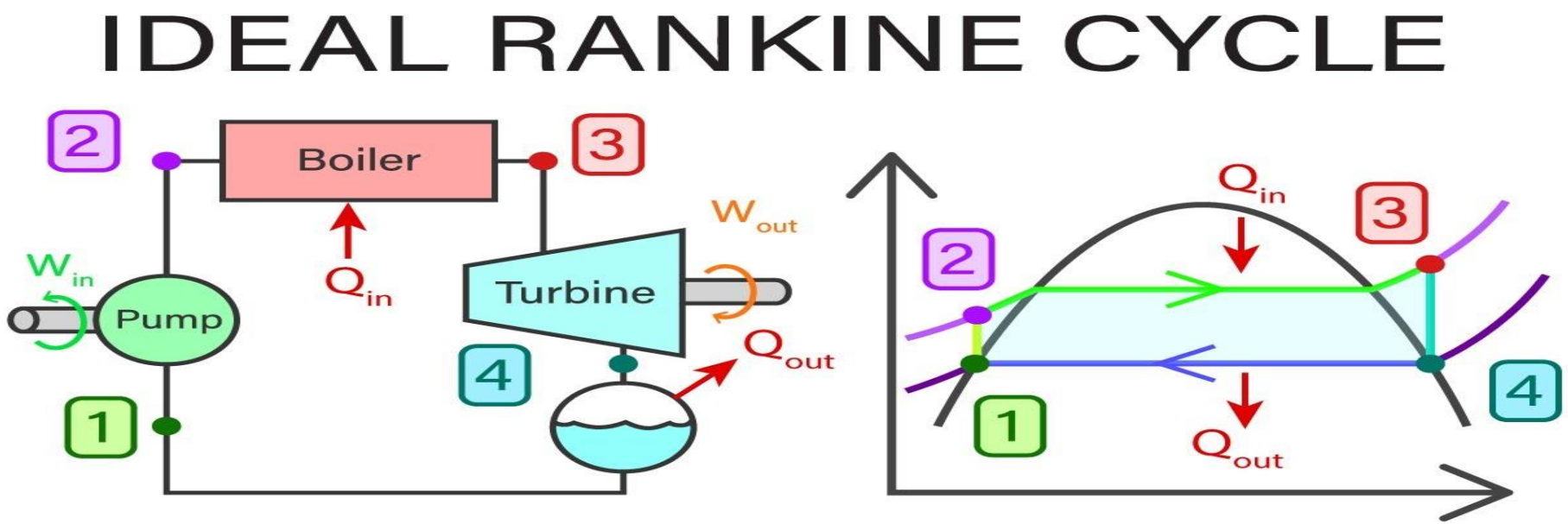
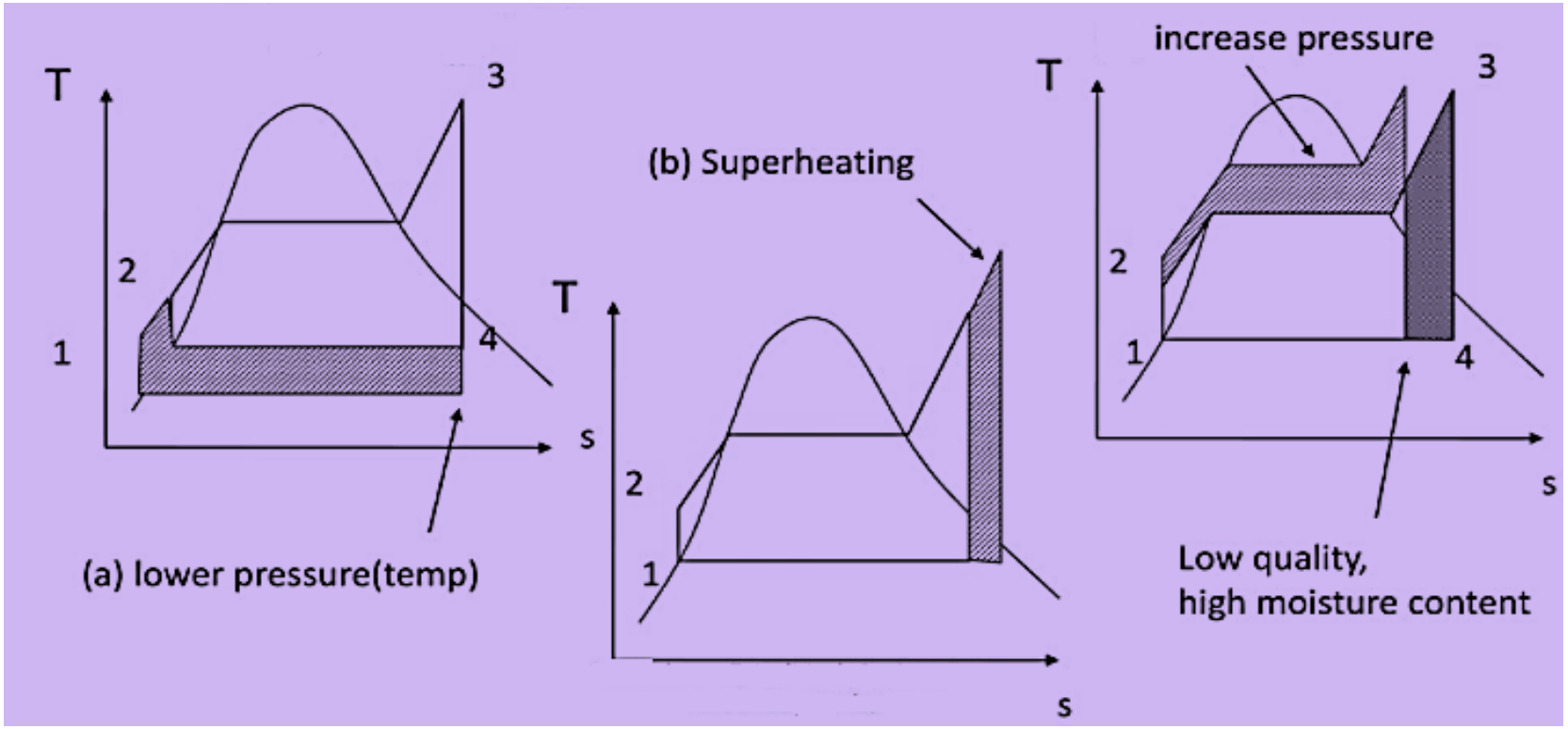
Rankine Cycle

- The Rankine cycle is the fundamental operating cycle of all power plants where an operating fluid is continuously evaporated and condensed.
- In an ideal Rankine cycle, the system executing the cycle undergoes a series of four processes: two isentropic (reversible adiabatic) processes alternated with two isobaric processes:



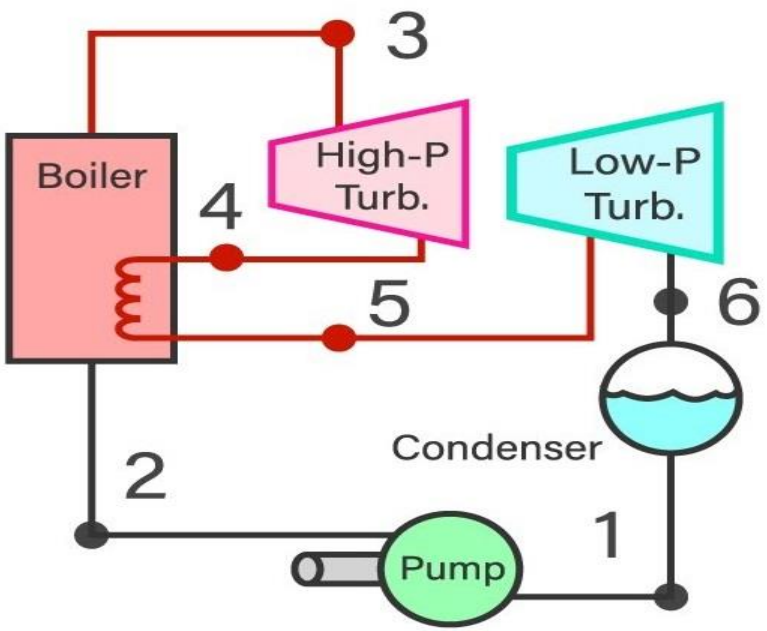
Improvisations in Rankine Cycle

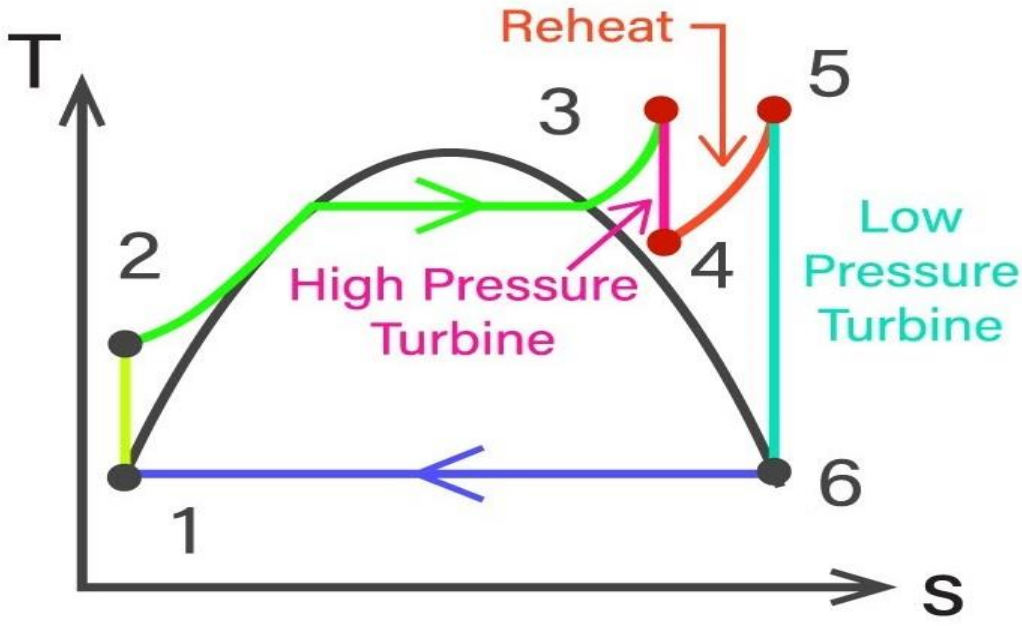
- In Rankine cycle thermal efficiency can be improved by,
- (a) Lowering the condensing pressure
- (b) Superheating the steam to higher temperature
- (c) Increasing the boiler pressure



Reheating in Rankine Cycle

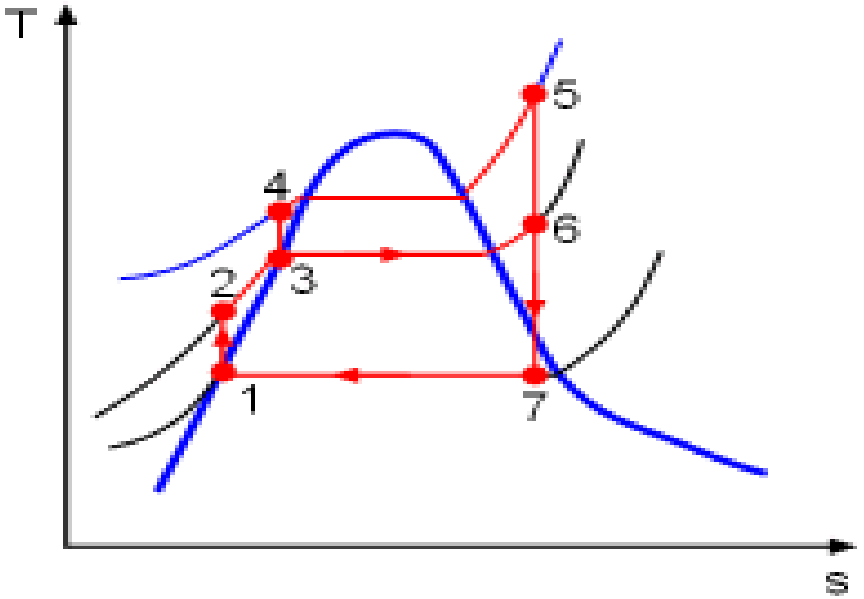
- The optimal way of increasing the boiler pressure without increase in the moisture content in the exiting vapour is to reheat the vapour, after it exits from a first-stage turbine and redirect this reheated vapour into a second turbine.
- By reheating, the averaged temperature of the vapour entering the turbine is increased, thus, it increases the thermal efficiency of the cycle.

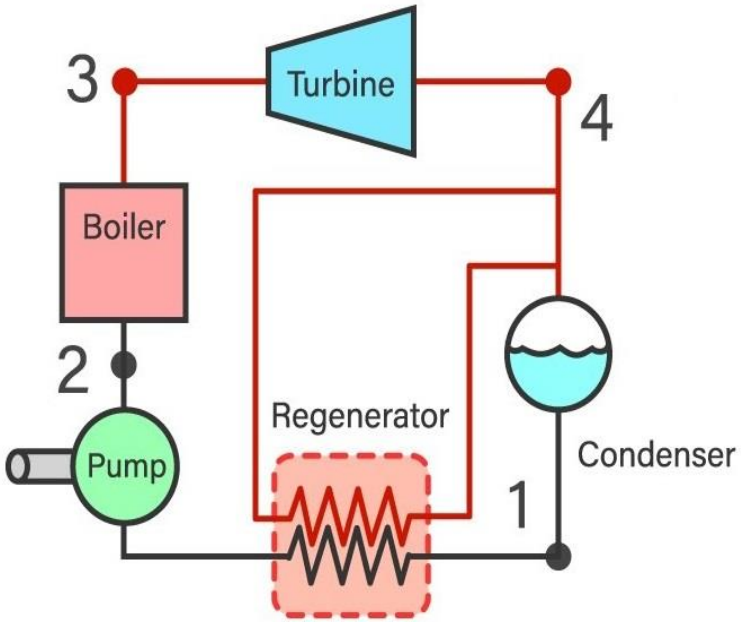




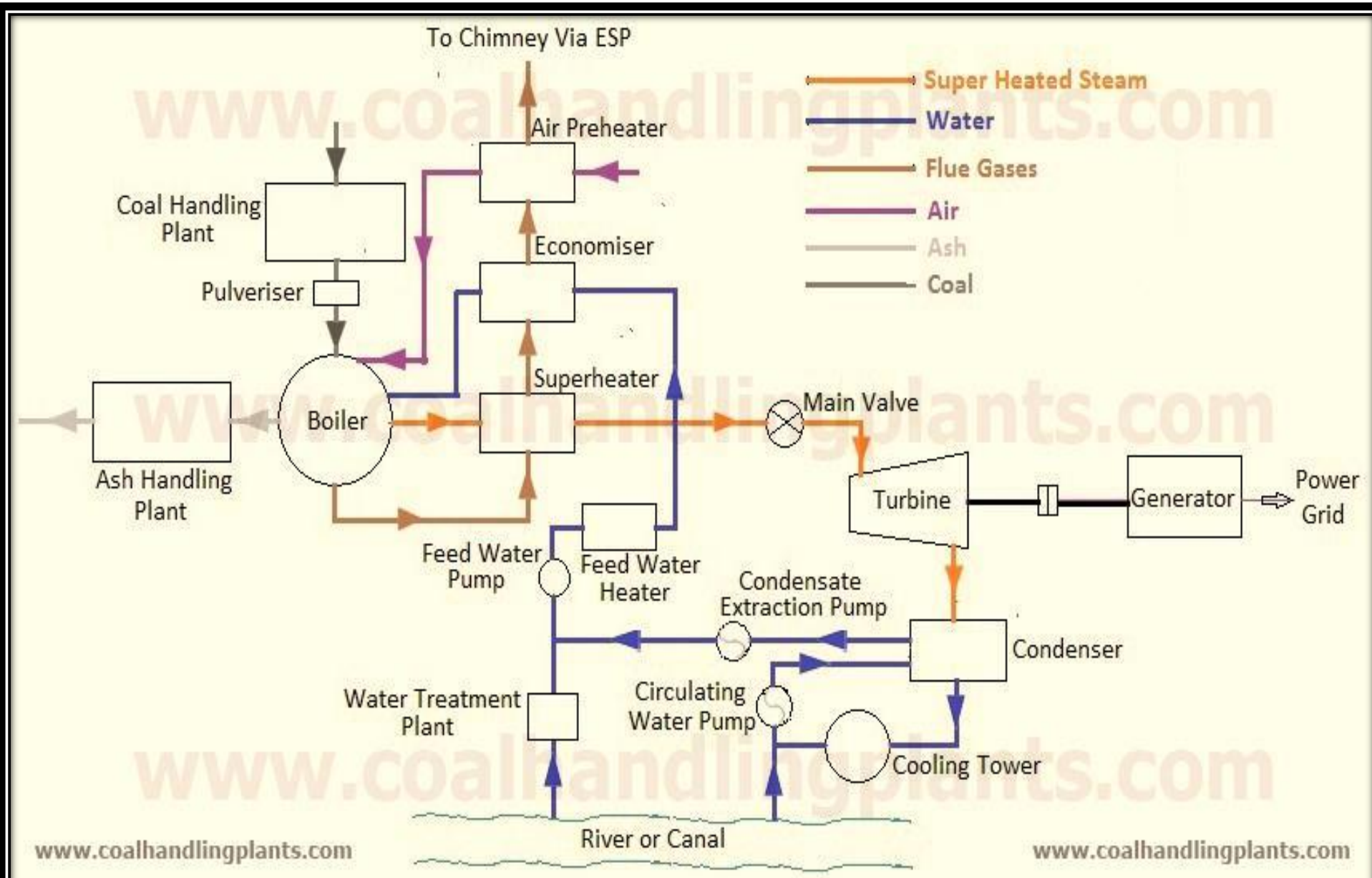
Regenerative in Rankine Cycle

- Use regenerator to heat up the liquid (feed water) leaving the pump before sending it to the boiler, therefore, increase the averaged temperature (efficiency as well) during heat addition in the boiler.
- It improve efficiency by increasing feed water temperature before it enters the boiler. (i)Open feed water: Mix steam with the feed water in a mixing chamber. (ii) Closed feed water: No mixing.





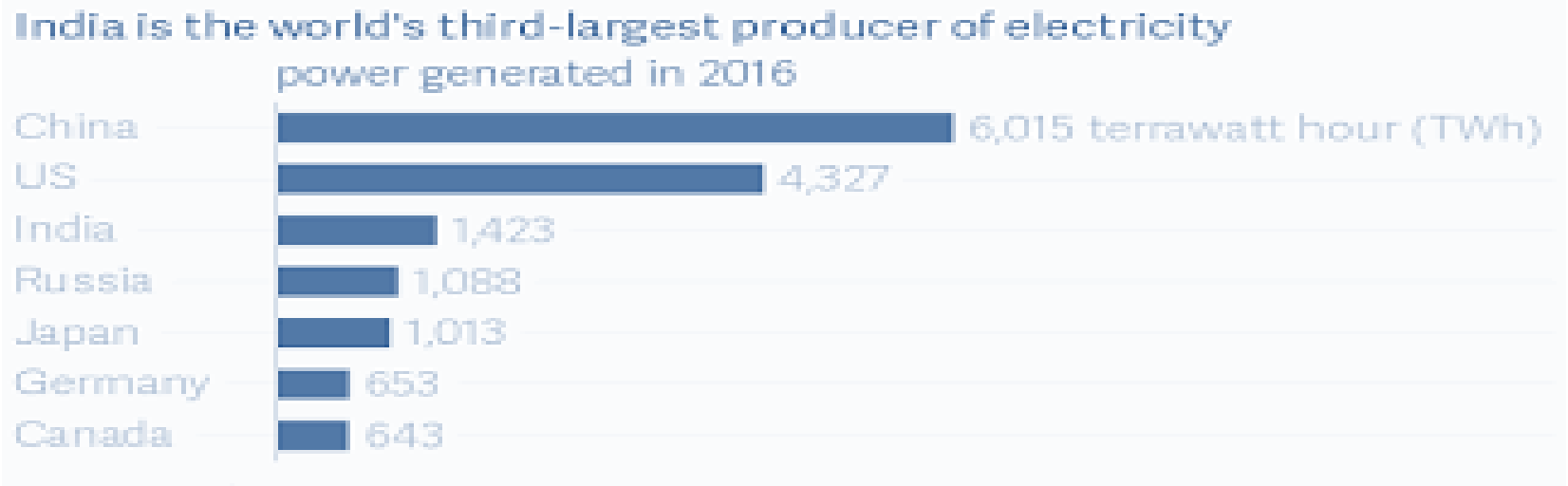
General Layout of TPP

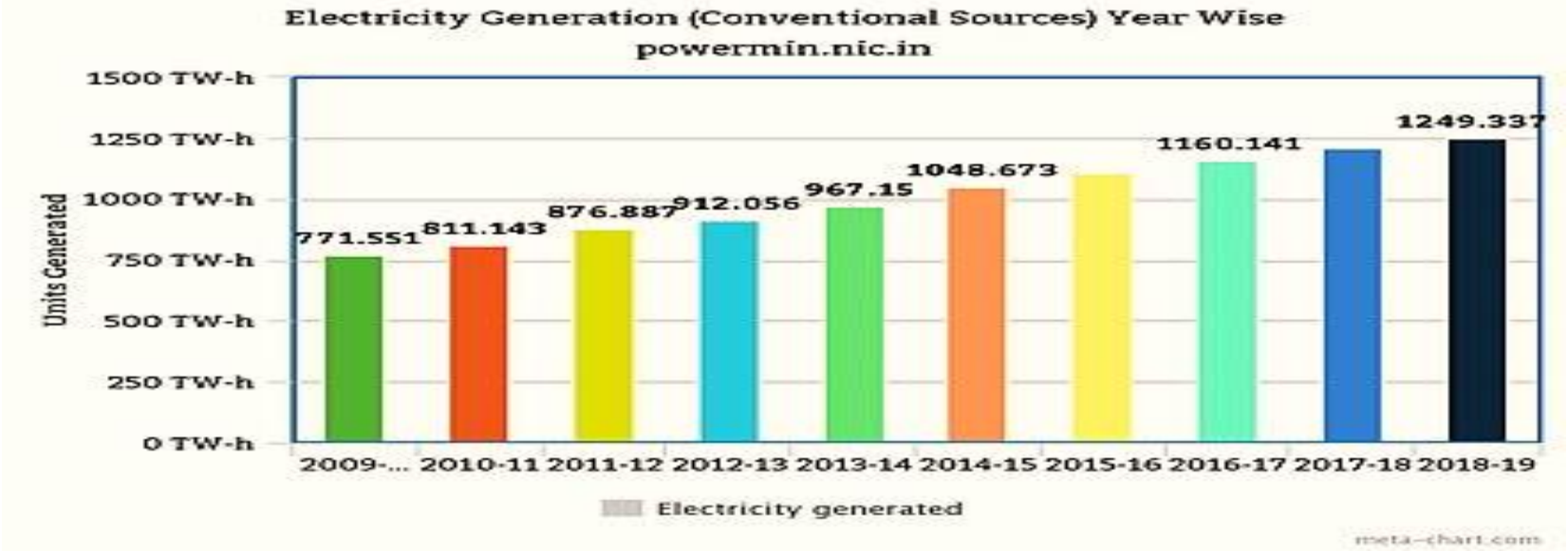


FACTOR AFFECTING SELECTION OF LOCATION OF THERMAL POWER PLANT

Factors	Sub Factors
Availability of resources	Land availability, Water availability, Fuel availability, Skilled manpower availability.
Economical impact	Land acquisition cost, Investment cost, Operation and maintenance cost, Payback period, Future development limitations, Possibility of Site expansion.
Environment concern	Degradation of local air quality, Land Use Impacts, Dust Noise.
Social concern	Job creation, Public acceptance, Number of relocation, Distance from public area.
Accessibility	Road/Rail/Airport accessibility, Transmission grid accessibility, Electricity consumption point, Urban area accessibility.

PRESENTS STATUS OF POWER GENERATION IN INDIA

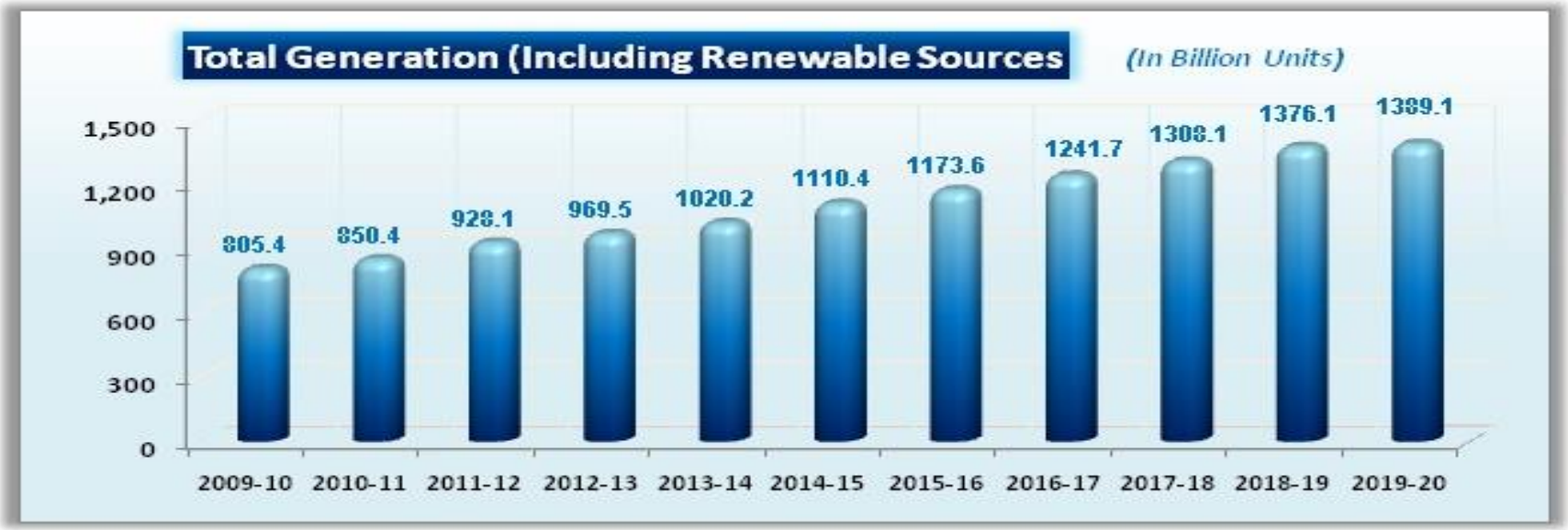




Generation and growth in conventional generation in the country during 2009-10 to 2020-21

Year	Energy Generation from Conventional Sources (BU)	% of growth
2009-10	771.551	6.6
2010-11	811.143	5.56
2011-12	876.887	8.11
2012-13	912.056	4.01
2013-14	967.150	6.04
2014-15	1048.673	8.43
2015-16	1107.822	5.64
2016-17	1160.141	4.72
2017-18	1206.306	3.98
2018-19	1249.337	3.57
2019-20	1252.611	0.26
2020-21	91.913	-22.85

Generation and growth in conventional generation in the country during 2009-10 to 2020-21



Generation and growth in conventional generation in the country during 2009-10 to 2020-21

Fuel	MW	% of Total
Total Thermal	2,30,600	62.8%
Coal	1,98,525	54.2%
Lignite	6,610	1.7%
Gas	24,955	6.7%
Diesel	510	0.1%
Hydro (Renewable)	45,699	12.4%
Nuclear	6,780	1.9%
RES* (MNRE)	87,269	23.6%
Total	370,348	

RES (Renewable Energy Sources) include Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power, Solar and Wind Energy.