Power Stations

Thermal power stations

Introduction

- A **thermal power station** is a power plant in which the prime mover is steam driven.
- Water is heated, turns into steam and spins a steam turbine which drives an electrical generator.
- After the turbine, the steam is condensed in a condenser and recycled to where it was heated; this is known as a Rankine cycle.
- Variation in the design is due to the different fossil fuel.
- *Energy center* convert heat energy into electrical energy.
- Thermal power plants also are designed to produce heat energy for industrial purposes of district heating, or desalination of water, in addition to generating electrical power.
- Globally, fossil fueled thermal power plants produce a large part of man-made CO_2 emissions to the atmosphere, and efforts to reduce these are varied and widespread.

Introduction

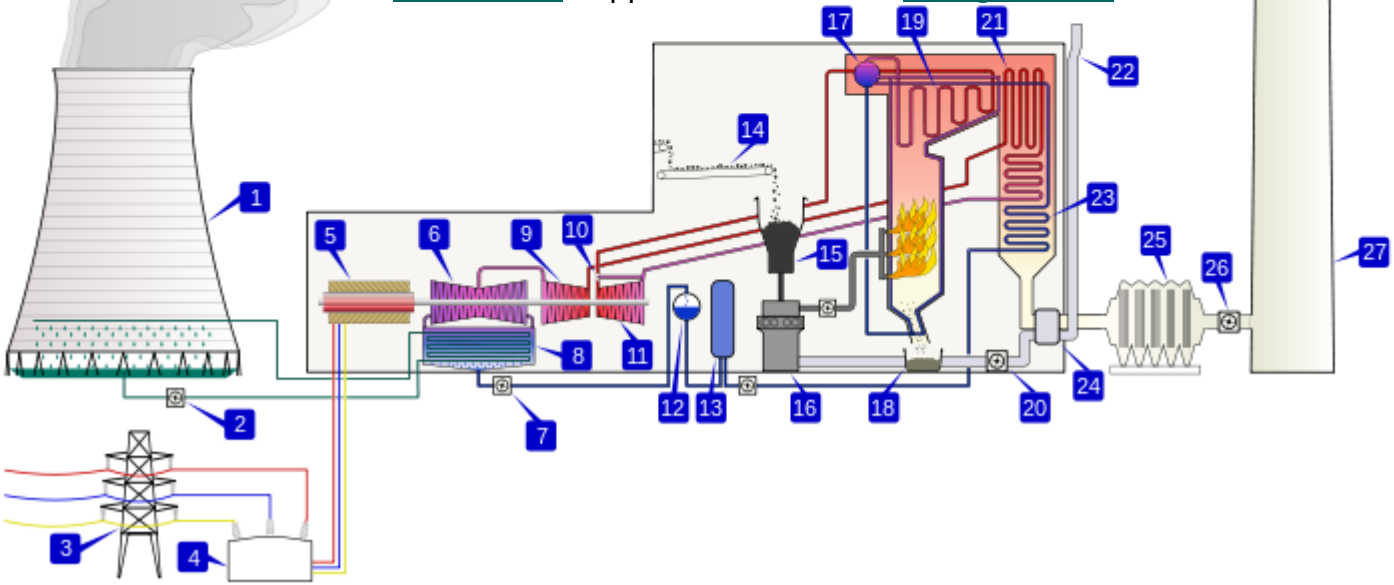
- Almost all coal, nuclear, geothermal, solar thermal electric, and waste incineration plants, as well as many natural gas power plants are thermal.
- Natural gas is frequently combusted in gas turbines as well as boilers. The waste heat from a gas turbine can be used to raise steam, in a combined cycle plant that improves overall efficiency.
- Power plants burning coal, fuel oil, or natural gas are often called *fossil-fuel power plants*.
- Some biomass-fueled thermal power plants have appeared also.
- Non-nuclear thermal power plants, particularly fossil-fueled plants, which do not use co-generation are sometimes referred to as *conventional power plants*.
- Commercial electric utility power stations are usually constructed on a large scale and designed for continuous operation.

Introduction

- Electric power plants typically use three-phase electrical generators to produce alternating current (AC) electric power at a frequency of 50 Hz or 60 Hz.
- Large companies or institutions may have their own power plants to supply heating or electricity to their facilities, especially if steam is created anyway for other purposes.
- Combined heat and power plants (CH&P plants), often called *co-generation plants*, produce both electric power and heat for process heat or space heating.
- Steam and hot water lose energy when piped over substantial distance, so carrying heat energy by steam or hot water is often only worthwhile within a local area, such as industrial plant, or district heating.

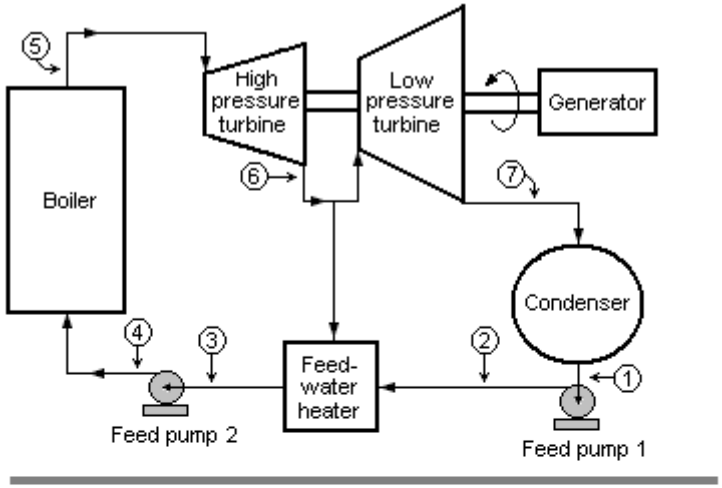
Typical diagram

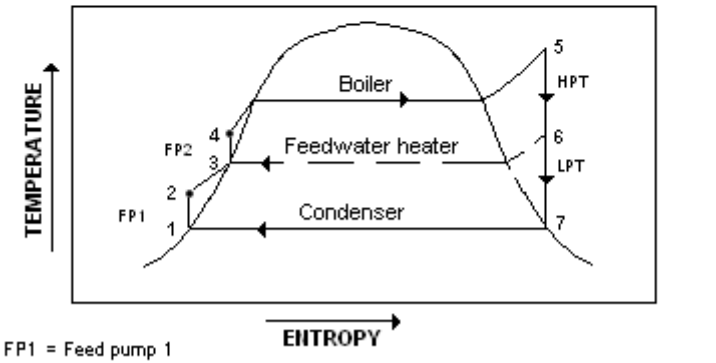
1. Cooling tower
2. Cooling water pump
3. transmission line (3-phase)
4. Step-up transformer (3-phase)
5. Electrical generator (3-phase)
6. Low pressure steam turbine
7. Condensate pump
8. Surface condenser
9. Intermediate pressure steam turbine
10. Steam Control valve
11. High pressure steam turbine
12. Deaerator
13. Feedwater heater
14. Coal conveyor
15. Coal hopper
16. Coal pulverizer
17. Boiler steam drum
18. Bottom ash hopper
19. Superheater
20. Forced draught (draft) fan
21. Reheater
22. Combustion air intake
23. Economiser
24. Air preheater
25. Precipitator
26. Induced draught (draft) fan
27. Flue gas stack



Rankine cycle

- A Rankine cycle with a two-stage steam turbine and a single feed water heater.





FP1 = Feed pump 1
FP2 = Feed pump 2
HPT = High pressure turbine
LPT = Low pressure turbine

Třebovice Power Station