A

Report of an

Industrial Visit to

Reliance Thermal Power Plant, Dahanu

Submitted By: **Sammed Suhas Gopalkar**

B.E. MECHANICAL

ROLL NO.: 30

INTRODUCTION TO THE COMPANY:

Reliance Power Limited, a part of the Reliance Anil Dhirubhai Ambani Group, was established to develop, construct and operate power projects in the domestic and international markets. Reliance Energy Limited, an Indian private sector power utility company along with the Anil Dhirubhai Ambani Group promotes Reliance Power. It ranks among India's top listed private companies on all major financial parameters, including assets, sales, profits and market capitalization. A constituent of the Reliance -Anil Dhirubhai Ambani Group,Reliance Energy is India 's foremost private sector utility with aggregate estimated revenues of Rs 9,500 crore (US$2.1 billion)and total assets of Rs 10,700 crore (US$2.4 billion). Reliance Energy distributes more than 21 billion units of electricity to over 25 million consumers in Mumbai, Delhi, Orissa and Goa, across an area that spans 1,24,300 sq.kms. It generates 941 MW of electricity, through its power stations located in Maharashtra, Andhra Pradesh, Kerala, Karnataka and Goa. Reliance Energy is currently pursuing several gas, coal, wind and hydro-based power generation projects in Maharashtra, Uttar Pradesh, Arunachal Pradesh and Uttaranchal with aggregate capacity of over 12,500 MW. These projects are at various stages of development.

INTRODUCTION TO RELIANCE THERMAL POWER PLANT, DAHANU:

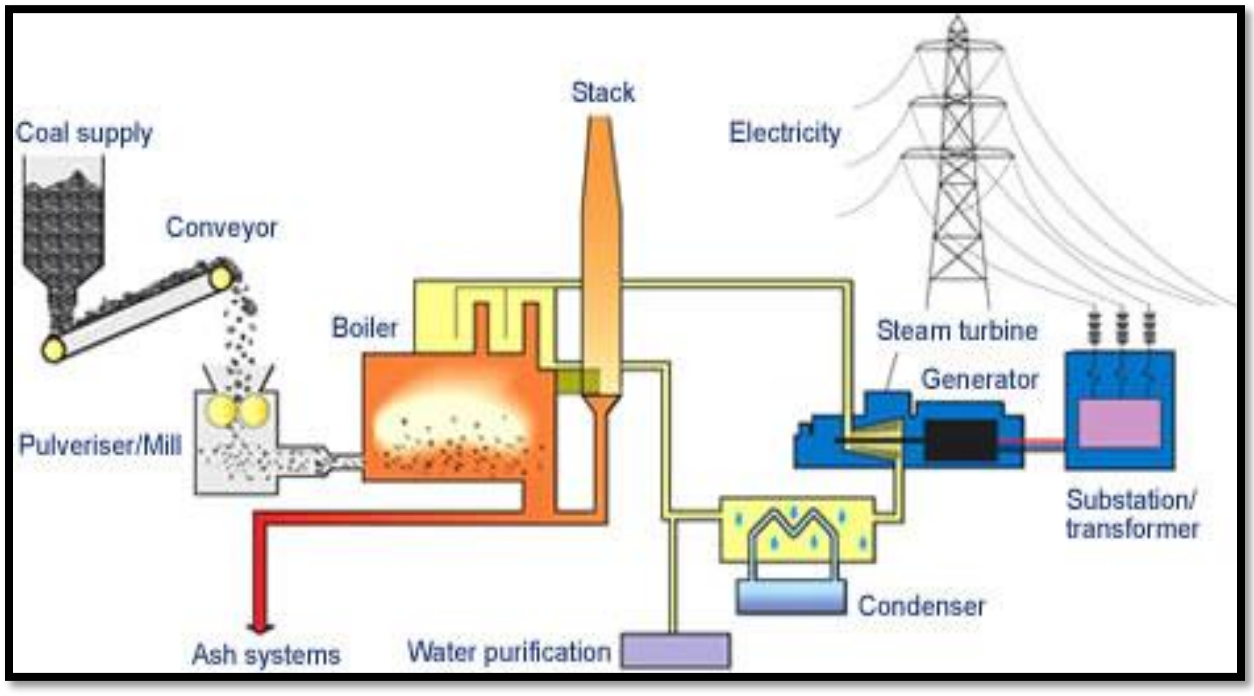
Thermal Power Station (DTPS) started its commercial operations in January 1996. As fuel, the plants use a mix of Indian washed coal and imported coal. The general blending ratio is 80: 20. The indigenous fuel is supplied from SECL (Korba) which is located about 1400 Kilometers from the plant site. Imported coal is received from various countries like Indonesia, South Africa. The plant has a generation capacity of 500 MW and supply power to suburban Mumbai. The company claims that it supply power at the cheapest tariff of Rs 2.45 per unit compared to other power utilities. The plant has got many awards for its distinctive features in terms of performance, technological innovation and sustainability. The plant is the first Power Company to be certified ISO 14001 for its environmental management system & ISO 9001for its quality management System.

MAJOR MILESTONES & ACHIEVEMENTS:

- The land development commenced in the year 1990
- The main plan contract got finalized in the year 1991
- Unit 1 was synchronized on 6th January 1995
- Unit No. 2 was synchronized on 29th March 1995.
- The power station commercially commenced its operation in 1996.

OVERVIEW OF THE PLANT:

In a coal based power plant coal is transported from coal mines to the power plant by railway in wagons or in a merry-go-round system. Coal is unloaded from the wagons using wagon tippler units, to a moving underground conveyor belt. 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. From the crusher house the coal is either stored in dead storage (generally 40 days coal supply) which serves as coal supply in case of coal supply bottleneck or to the live storage(8 hours coal supply) in the raw coal bunker in the boiler house. Raw coal from the raw coal bunker is supplied to the Coal Mills by a Raw Coal Feeder. The Coal Mills or pulverizer pulverizes the coal to 200 mesh size. The powdered coal from the coal mills is carried to the boiler in coal pipes by high pressure hot air. The pulverized coal air mixture is burnt in the boiler in the combustion zone. Generally in modern boilers tangential firing system is used i.e. the coal nozzles/ guns form tangent to a circle. The temperature in fire ball is of the order of 1300˚C. The boiler is a water tube boiler hanging from the top. Water is converted to steam in the boiler and steam is separated from water in the boiler Drum. The saturated steam from the boiler drum is taken to the Low Temperature Superheater, Platen Superheater and Final Superheater respectively for superheating. The superheated steam from the final superheater 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 as the steam becomes wet at the HPT outlet. 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 in the Hotwell and is again sent to the boiler in a closed cycle. The rotational energy imparted to the turbine by high pressure steam is converted to electrical energy in the Generator.



MAJOR COMPONENTS OF DTPS:

- Coal Handling Plant (CHP)
- Boiler
- Turbine
- Reheater
- Superheater
- Turbo-Separator
- De-superheater
- Coal Mill
- Air Preheater
- Electrostatic Precipitator
- Ash Handling Plant
- Fuel-Oil Handling Plant
- Sulphur Treatment Plant
- Compressor house

The Heat Source:

Coal is used as the heat source. The required amount of coal is obtained from Chhattisgarh coal mines. Coal is brought by means of railway. Coal is then unloaded at the wagon tippler location. Here the coal is unloaded by rotating the wagon through 170^0. Unloading of each wagon takes 2 minutes. The wagon is rotated through 170 degrees by means of a gear mechanism which ensures the 170 degree rotation and the rotation is controlled by a controller placed nearby. There is a vertical and a horizontal plate which support the wagon while it rotates through the said angle. The coal consumption is 4000M Ton.

Crushing of Coal:

The stacked coal is reclaimed as per the requirement. The coal is brought to a double roll crusher. Here it is crushed to a size of 25mm. But for practical use, the coal needs to be further powdered. This is achieved in the Pulveriser. In the pulveriser, the coal is pulverized to the size of Talcum Powder. The crushed coal is carried to the boiler using jet of hot air.

Boiler:

In this Plant, the boiler used is a water tube boiler. The size of the boiler is (13*10) m. It has a height of 60-65m. The boiler tube is made of Carbon Steel. The Boiler is CE made. The boiler operating temperature is 1100^0 c.

Water for Boiler:

The water used in the boiler to produce steam is obtained from Soorya dam. The Soorya dam is located 32Km away from Dahanu. This water is then treated to remove suspended particles. It is then sent for demineralization. The water passes through the tube in the boiler.

Steam Generated:

The steam is generated inside the boiler. The generated steam has a temperature of 540^0c. It has a pressure of 150 kg/cm^2.

Turbine:

The steam from the boiler at a temperature of 540^0 c and 150 kg/cm^{2}is passed to the turbine. The turbine operates at a speed of 3000 rpm. The turbine blades are made of chromium or molybdenum or vanadium. There are three types of turbines installed in each unit. The types are High Pressure turbine, Intermediate Turbine and Low pressure Turbine.

Generator:

The turbine is coupled to a generator. Electric energy generated is then stepped up from 16kV to 220kV using a step-up transformer.

Exhaust from Boiler:

The exhaust gases from the boiler is at a temperature of 340^0 c and a pressure of 40 kg/cm^2. The flue gas is made to pass through a air pre-heater unit. It is reheated to 537^0 c. It is then sent to the Intermediate Pressure Turbine and then at a pressure of 37 Kg/cm^2 to Low Pressure turbine.

The flue gases from the pre-heater unit are sent to the electrostatic Precipitator unit where the ash is separated from the gases. The efficiency of this separation of ashes is 100%.

The chimney of this plant is the highest chimney in Asia for 250 MW power plant. It has a height of 275.3m.

Ash from The Exhaust:

The ash from the flue gases is collected in a hopper. This ash is then marketed to various customers who use it for various purposes like cement, brick manufacturing, gardening, road filling, etc. The revenue generated from the ash sales itself is sufficient to fulfill the wages of all the employees.

Cooling:

To perform the function of cooling, Sea water is directly used. There are no cooling towers in the power plant. For using sea water, the pipes are insulated so as to prevent it from rusting.

Governing of Turbines:

For governing of the turbines, an electro hydraulic governor is used.

Sensors Used:

Various sensors are used for the in process control. The various sensors used are RTD, Stroboscope, Pressure sensor, Flow measuring sensor, Hall Effect Sensor, etc.

ENERGY CONSERVATION:

The organization's social responsibility towards the environment is evident in the adaptation of clean technology and stringently following the environmental safety guards:

- Use of blended coal with imported low ash coal. FGD installation.
- Use of beneficiated coal.
- Ammonia injection for reduction of Particulate matter.
- Dry fly ash collection system with classification system installation. STP recycling.
- Paper recycling.
- Ash utilization as cement replacement/land filling. Ash bricks manufacturing.
- Mass Tree plantation and Horticulture initiative.

Reliance Infrastructure DTPS has achieved remarkable results since it has consistently maintained its average heat rate of 2300 Kcal/kWh for the last five years. This is a major milestone considering the Central Electricity Regulatory Commission (CERC) has set a norm of 2500 Kcal/kWh for a unit of this size.

ENVIRONMENT SAFEGUARDS:

1) To prevent Air Pollution:
    - ESP of 99.9% efficiency for collection of fly ash from flue gases.
    - Online monitoring of emission levels of SOx, NOx, and TPM in Flue gas.
    - Four Ambient air quality monitoring Stations to measure SPM, RSPM, SOx, NOx, Along with one meteorological station for weather monitoring.
    - Mobile Van to monitor Ambient Air quality in remote areas.
2) Ash Disposal:
    - Four ash ponds for disposal of ash slurry.
    - Pond management designed to minimize pollutants in discharge effluent. Dry Fly Ash collection System for maximizing ash utilization.
3) Health and Safety Management:
    - Health & Safety Policy in place.
    - Emergency plan and Disaster Management system is in place. Occupational Health Management and check-ups.
    - Advanced fire protection system and equipment.
    - A First Coal fired TPS to achieve Four Star in British Safety Council ranking.
4) Green Belt Development:
    - To mitigate air pollution levels, a green belt has been developed around the project area. The development plan was devised after detailed studies and the high volume of tree plantations over the years is a credible effort.

CONCLUSION:

The Industrial Visit to the Reliance Thermal Power Plant, Dahanu was highly successful. We received insight of the whole plant right from the raw material (coal) procurement, processing, combustion and generation & transmission of electricity. The whole process was explained in-detail by the representative with detailed description about each equipment with their specifications. A doubt solving session with the Control Room In charge cleared all our queries. This kind of industrial exposure helped us to absorb the theoretical aspects of Thermal & Fluid Power Engineering more efficiently. We would highly appreciate more such visits in the future.