

Thermal Power Stations







Faculty of Engineering Mechanical Engineering Dept. Lecture (5)

on

Thermal Power Plant Unit Selection

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Unit Type

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Characteristics Of Steam Power Plant

- The desirable characteristic for a steam power plant are as follows :
- 1. Higher efficiency.
- 2. Lower cost.
- 3. Ability to burn coal especially of high ash content, and inferior coals.
- 4. Reduced environmental impact in terms of air pollution.
- 5. Reduced water requirement.
- 6. Higher reliability and availability.





Comparison of Gas Turbine Plants and Steam Plants

- 1. The capital cost of a gas turbine plant is lower than that of a steam plant of the same size.
- 2. It has no standby losses.
- 3. It requires lesser area than a steam plant of the same capacity.
- 4. It has less water requirement as compared to a steam plant.
- 5. Its foundations and buildings are simple and cheap.
- 6. They can be started and put on load more quickly than steam plants.
- 7. A gas turbine plant can be located very near the load even in the cities and towns.
- 8. The operating costs of a gas turbine plant are very high as compared to steam plants.
- 9. Gas turbine plants can be used only in small sizes about 50 MW or so.





Application of Gas Turbine Plants

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- 1. Peak load plants. Gas turbine plants are very suitable for use as peak load plants because they can be started and loaded quickly.
- 2. Base load plants. The operating cost of a gas turbine plant is very high. As such it is rarely used as base load plant. However if natural gas is abundantly available at some site, it may be economical to run it as a base load plant also.
- 3. Auxiliary power plant for thermal stations. Gas turbine plants of about 25 MW size are used in coal fired steam power plants for starting the auxiliaries of the plant. These machines are either accommodated within the main building or in a separate building situated conveniently on site. Many a time this gas turbine plant is also used as hot standby plant. Many 500 MW





Advantages of Diesel Plants

- 1. Their design and installation is simple.
- 2. They can be quickly procured, installed and commissioned.
- 3. The layout, design and construction of foundation and buildings for diesel plants are cheap and simple.
- 4. They can be started and put on load quickly without any standby losses and have good efficiency.
- 5. They require less space for fuel storage.
- 6. They are free from ash handling problems.
- 7. Their capital cost per kW of capacity is low.
- 8. The cooling water requirements for diesel plants are less than for steam plants.
- 9. They can be located very near the loads.





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Disadvantages of Diesel Plants

- 1. They can be used only in small sizes.
- 2. The high cost of diesel makes the operating costs of diesel plants very high.
- 3. Their useful life is very short, only about 5 years.
- 4. Their repair and maintenance costs are high.
- 5. Their overload capacity is small.





Applications of Diesel Plants

- 1. Emergency plant. A countless number of industries, all over the country, have installed diesel electric plants in their premises to maintain essential services when supply from the grid is not available
- 2. They are used for starting auxiliaries in steam power stations.
- 3. Mobile plants. Mobile diesel electric plants mounted on trailers are used for temporary and emergency purposes.





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Applications of Diesel Plants

- Peak load plant. A diesel plant can be started and loaded quickly. As such these plants can be used as peak load plants.
- 5. Standby plants. They can be used as standby plants when supply from grid is not available.
- 6. They can be used in remote locations where supply from grid is not available. The use of diesel electric plants during the construction stages of thermal and hydro electric power plants is very common.





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The heat content of gas turbine exhaust is quite substantial. This exhaust has a temperature of around 500°C. The oxygen content in this exhaust is around 16%. Instead of using regeneration to recover this heat, a combined gas turbine and steam cycle can be used. The gas turbine exhaust acts as a heat source for the steam plant cycle. The combined cycles have proved to be a success in many countries.





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The gas turbine exhaust passes through a heat exchanger to heat the feed water for the boiler of the steam plant





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The gas turbine exhaust is used as preheated air for the boiler of the steam plant











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Cogeneration, also known as combined heat and power (CHP), refers to a group of proven technologies that operate together for the concurrent generation of electricity and useful heat in a process that is generally much more energy-efficient than the separate generation of electricity and useful heat.

The typical method of separate centralized electricity generation and on-site heat generation has a combined efficiency of about 45 percent whereas cogeneration systems can reach efficiency levels of 80 percent.









Lecture (5) -Thermal Power Stations - 4th year







