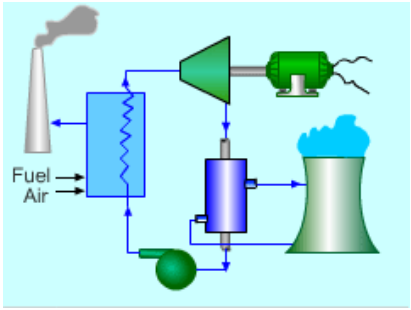

بسم الله الرحمن الرحيم

Thermal Power Stations



Kafrelsheikh University
جامعة كفر الشيخ

Faculty of Engineering
Mechanical Engineering Dept.

Lecture (1)

on

Thermal Power Stations Planning and Design Considerations (Load Forecasting)

By

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Course Syllabus

Text Books:	**Lectures notes**	
References:	1. 1. V. K. Mehta, Principals of Power System, 4th, S Chand & Co Ltd; , 2005 2. 2. A. K Raja, Power Plant Engineering, New Age International (P) Ltd., Publishers, 2006	
Evaluation:	1. Homework, attendance and assignments; equivalent 20%. 2. Mid exam; equivalent 20%. 3. Final exam; equivalent 60%.	
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Course Syllabus

1. Load curves of thermal power station.
2. Optimum load division between units.
3. Location or site selection considerations and characteristics of thermal power stations.
4. Thermal power station units selection.
5. Performance factors of thermal power station.
6. Cost of electrical energy rate.
7. Types of furnaces and boilers and boilers heat balance.
8. Types of draught systems.

Power Station Definition

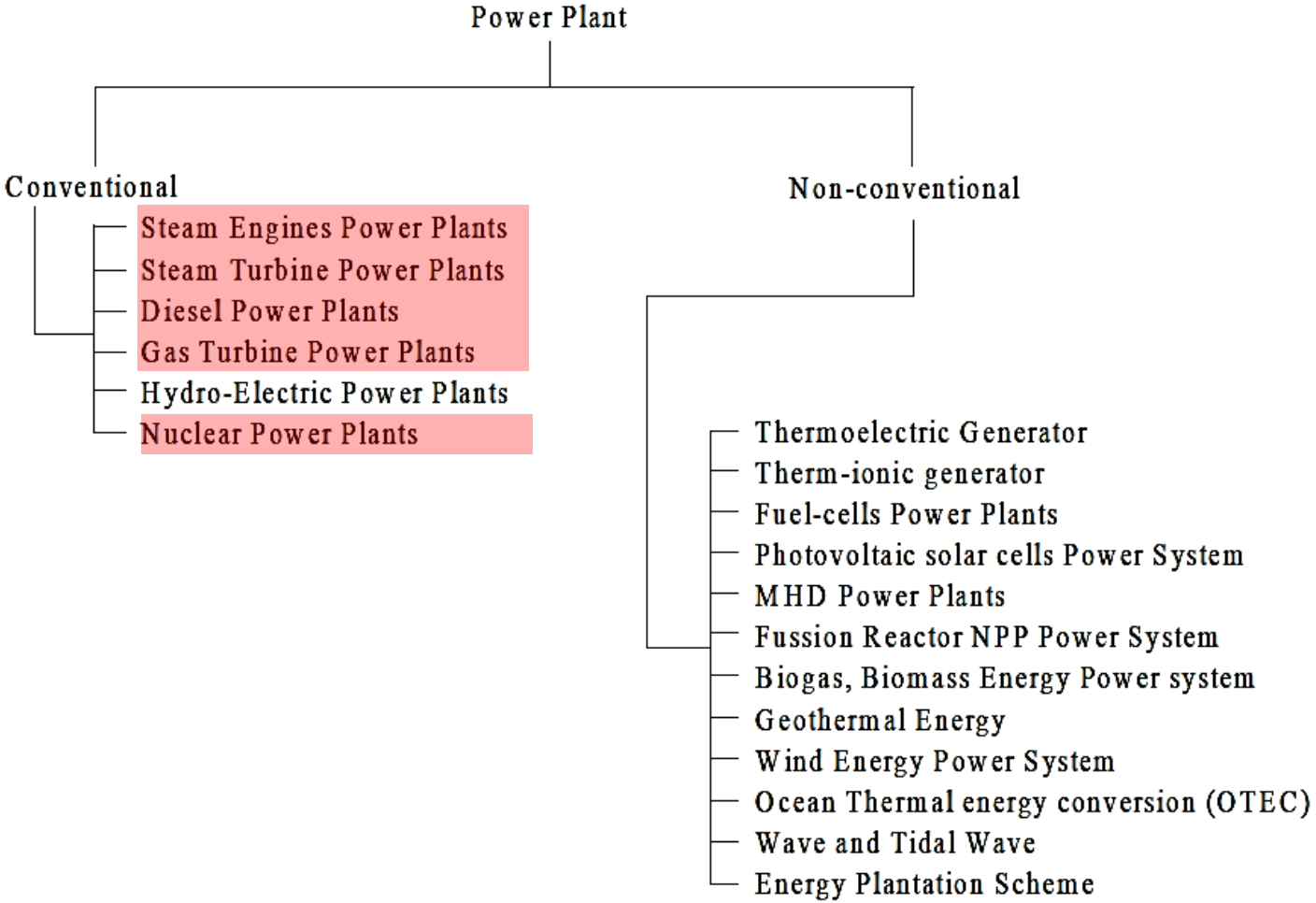
A power station (also referred to as a generating station, power plant, powerhouse or generating plant) is an industrial facility for the generation of mechanical or electric power.

Unit Collection of Power Plant

There may be several units which are described below:

1. Energy source (Heat, wind, water etc.)
2. Turbine
3. Generator (a rotating machine that converts mechanical power into electrical power by creating relative motion between a magnetic field and a conductor)

Classification of Power Plants



Classification of Power Plants

On the basis of primary source or fuel

1. Nuclear power plants
2. Geothermal power plants
3. Fossil-Fuel power plants
4. Biomass-Fuelled power plants
5. Solar thermal power plants

Classification of Power Plants

On the basis of prim mover

1. **Steam Turbine Power Plants**
2. **Gas Turbine Power Plants**
3. **Combined Cycle Power Plants**
4. **Internal combustion reciprocating engines are used for small cogeneration plants likes - Hospitals, office buildings, industrial plants, and other critical facilities.**
5. **Micro turbines, Stirling engine and internal combustion reciprocating engines are low-cost solutions for using opportunity fuels, such as landfill gas, digester gas from water treatment plants and waste gas from oil production.**

Classification of Power Plants

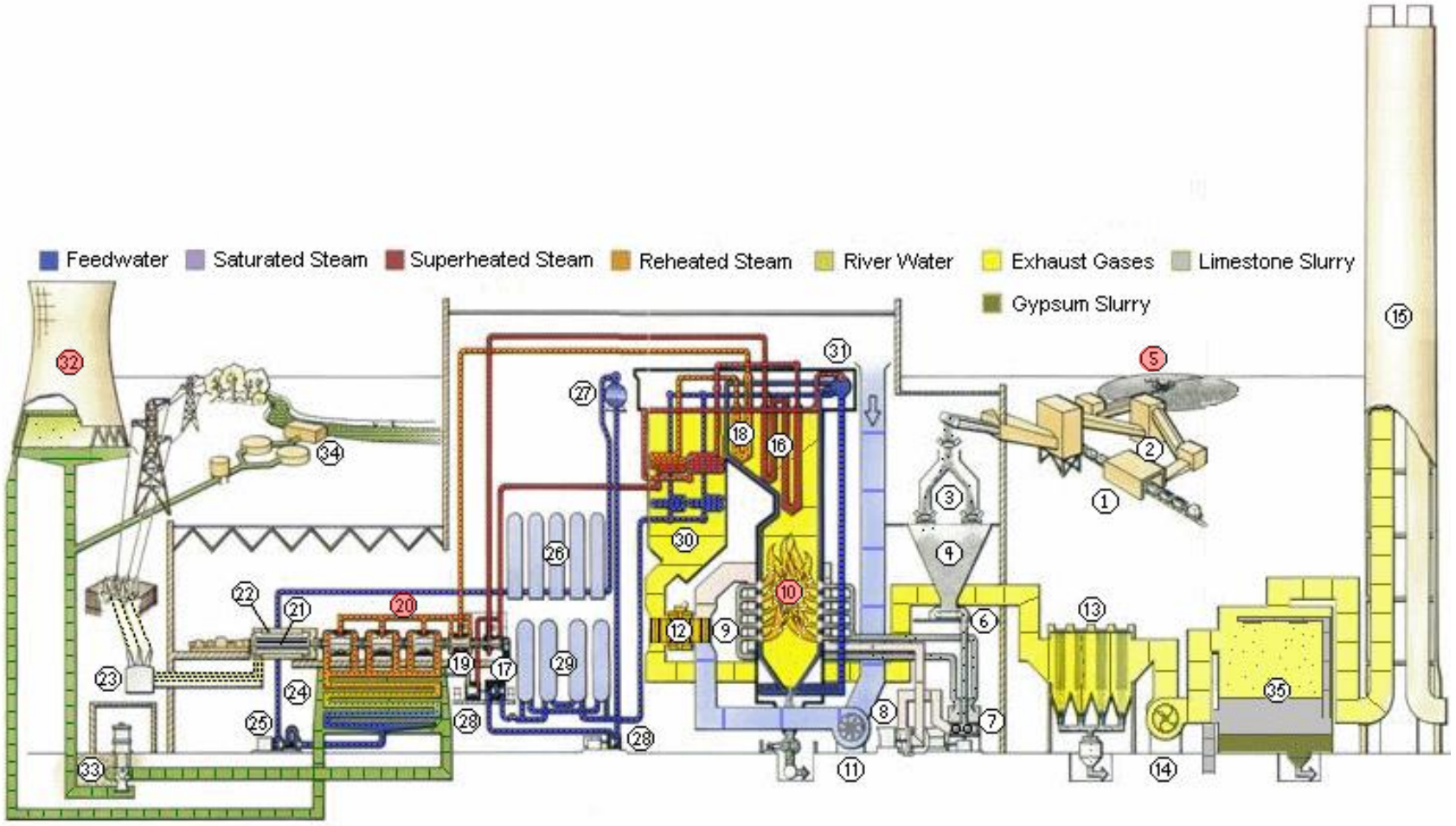
On the basis of duty

1. **Base Load Power Plants:** Base Load Power Plants run nearly continually to provide that component of system load that doesn't vary during a day or week.
2. **Peaking Power Plants:** Peaking power plants meet the daily peak load, which may only be for a one or two hours each day. While their incremental operating cost is always higher than base load plants
3. **Load Following Power Plants:** Load following power plants can economically follow the variations in the daily and weekly load, at lower cost than peaking plants and with more flexibility than base load plants.

Performance Efficiencies

All thermal power plants produce waste heat energy as a by product of the useful electrical energy produced. The amount of waste heat energy equals or exceeds the amount of energy converted into useful electricity . **Gas-fired** power plants can achieve "**50%**" conversion efficiency while **coal and oil** plants achieve around "**30–49%**".

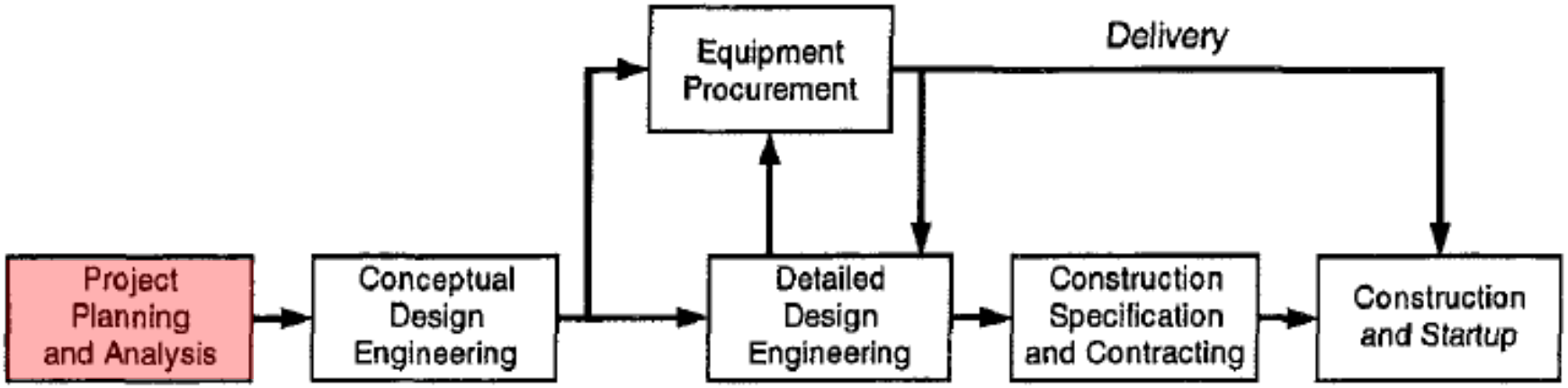
Thermal Power Plant Components



Thermal Power Plant Components

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. De aerator
13. Feed water heater
14. Boiler steam drum
15. Super heater
16. Forced draught (draft) fan
17. Re heater
18. Combustion air intake
19. Induced draught (draft) fan

Power Plant Design Process



TPS Planning Studies

A system planning study:

1. Defines the predicted timing and size for future capacity additions in a specific system.
2. Determines the most economical capacity expansion plan on the basis of specific study assumptions.
3. Evaluates the impact of demand-side management options for reducing electrical loads.

"Integrated resource planning" and "least cost planning" are options that include evaluations of both supply-side and demand-side options.

Each system planning study is tailored for a specific system and may meet specific requirements of a regulating agency or financial lending institution. However, several basic activities and tasks are common to most system planning studies.