

ENERGY, ECONOMIC & ENVIRONMENTAL ISSUES

⇒ Types of tariffs in power system:-

The tariff is the rate at which the electrical energy is sold. There are various types of tariffs flowed in the market. This post will be give the brief idea about different tariff types.

⇒ Tariff:-

Electrical energy produced by the power system is delivered to a large no customers. The tariff becomes the attention for the electric supply company. The company has to ensured that the tariff such that it not only recovers total cost of producing electrical energy but also earns profit on the capital investment.

⇒ Tariff types:-

- 1) Simple tariff
- 2) flat rate tariff
- 3) Block rate tariff
- 4) Two part tariff
- 5) power factor tariff
- 6) Three part tariff

Simple Tariff: When a consumer consumes energy at a fixed rate per unit of energy consumed. It is known as "Simple Tariff".

flat rate Tariff:

When different types of consumers are charged at different uniform per unit rates. It is known as "flat rate Tariff".

Block Rate Tariff:

When a given block of energy is charged at a specified rate and the succeeding blocks of energy are charged at progressively reduced rate is known as "Block rate Tariff".

Two part Tariff:

When a rate of electrical energy is charged on the basis of maximum demand of the units consumed is called "Two-part tariff".

power factor Tariff:

The tariff which the power factor of the consumers is taken into account is known as "power factor Tariff".

⇒ Load distribution parameters:-

* Load characteristics:

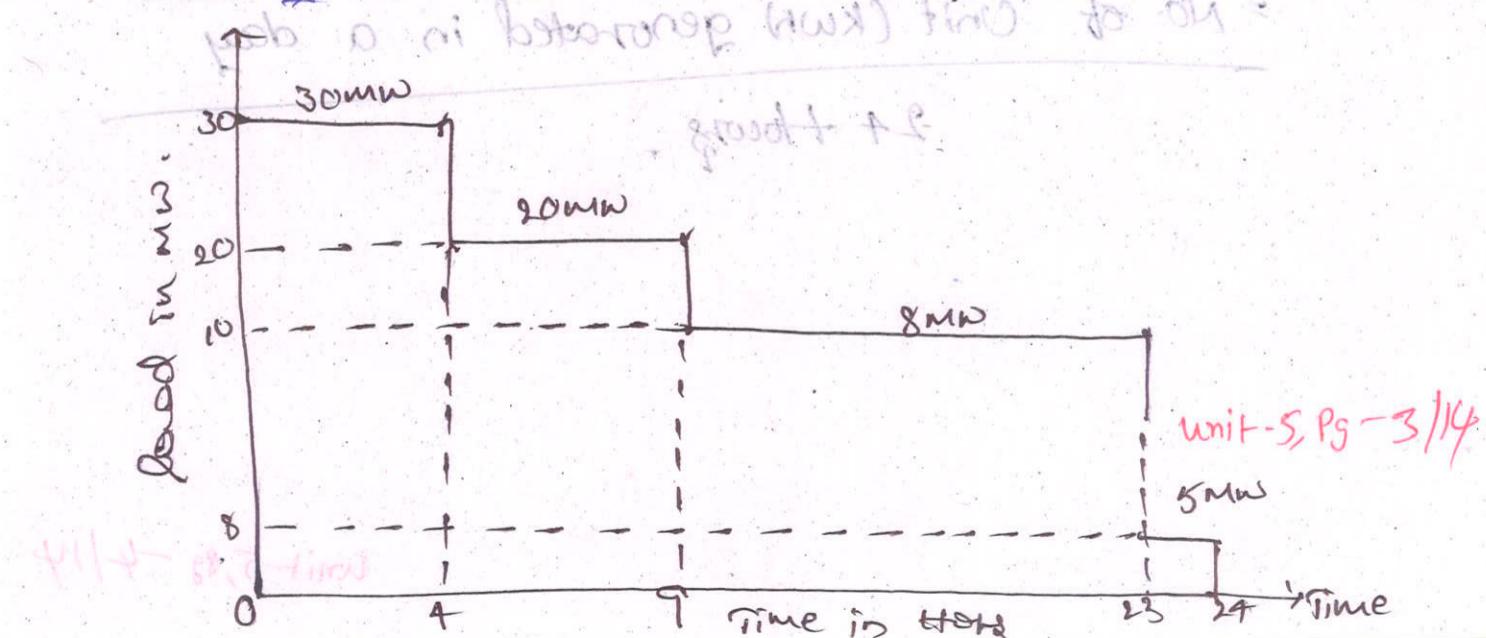
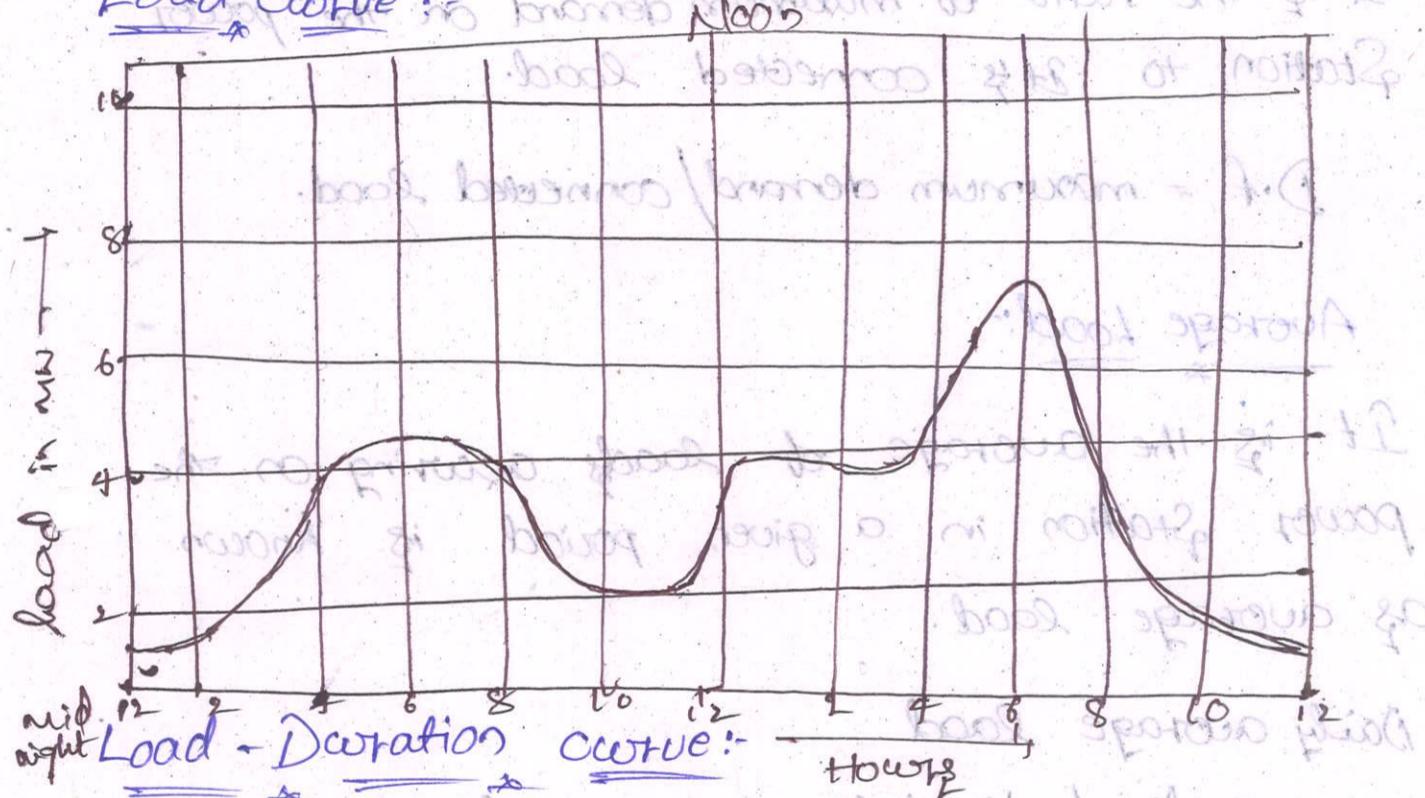
⇒ The load characteristics plays an important role in

* Determining the total power and energy requirements of the system.

* planning the installed capacity of a power plant.

* Selection of suitable generation capacity for each unit of the plant.

Load Curve :-



\Rightarrow Connected Load: - ~~maximum continuous load~~

It is the sum of continuous of all the equipments connected to Supply System.

\Rightarrow Maximum Demand: - ~~maximum load during a given period~~

It is the greatest demand of load on the power station during a given period.

\Rightarrow Demand factor: - ~~ratio of maximum demand to connected load~~

It is the ratio of maximum demand on the power Station to its connected load.

$$D.f = \text{maximum demand} / \text{connected load}$$

\Rightarrow Average Load: - ~~average load~~

It is the average of loads occurring on the power station in a given period is known as average load.

Daily average load

= No. of Unit (kwh) generated in a day

24 Hours

Unit 5 Pg 4/14

Unit 5 Pg 4/14

⇒ Load factor:

The ratio of average load to the maximum demand during a given period is known as Load factor.

$$\text{Load factor} = \frac{\text{Average load}}{\text{max. demand.}}$$

⇒ Diversity factor:

It is the ratio of sum of individual maximum demands to the maximum demand on the power station.

$$\text{Diversity factor} = \frac{\text{Sum of individual max. demands}}{\text{max. demand on power station}}$$

⇒ Capacity factor:

It is the ratio of actual energy produced to the maximum possible energy that could have been produced during a given period.

$$\text{Capacity factor} = \frac{\text{Actual energy produced}}{\text{max. energy that could have been produced.}}$$

$$\text{Annual capacity load} = \frac{\text{Annual kwh output}}{\text{plant capacity} \times 8760}$$

unit-S Pg - 514

Plant Use Factor :-

It is the ratio of kwh generated to the product of plant capacity and the number of hours for which the plant was in operation.

Plant Use Factor $\rightarrow \frac{\text{Station output in kwh}}{\text{Plant capacity} \times \text{hours of use}}$

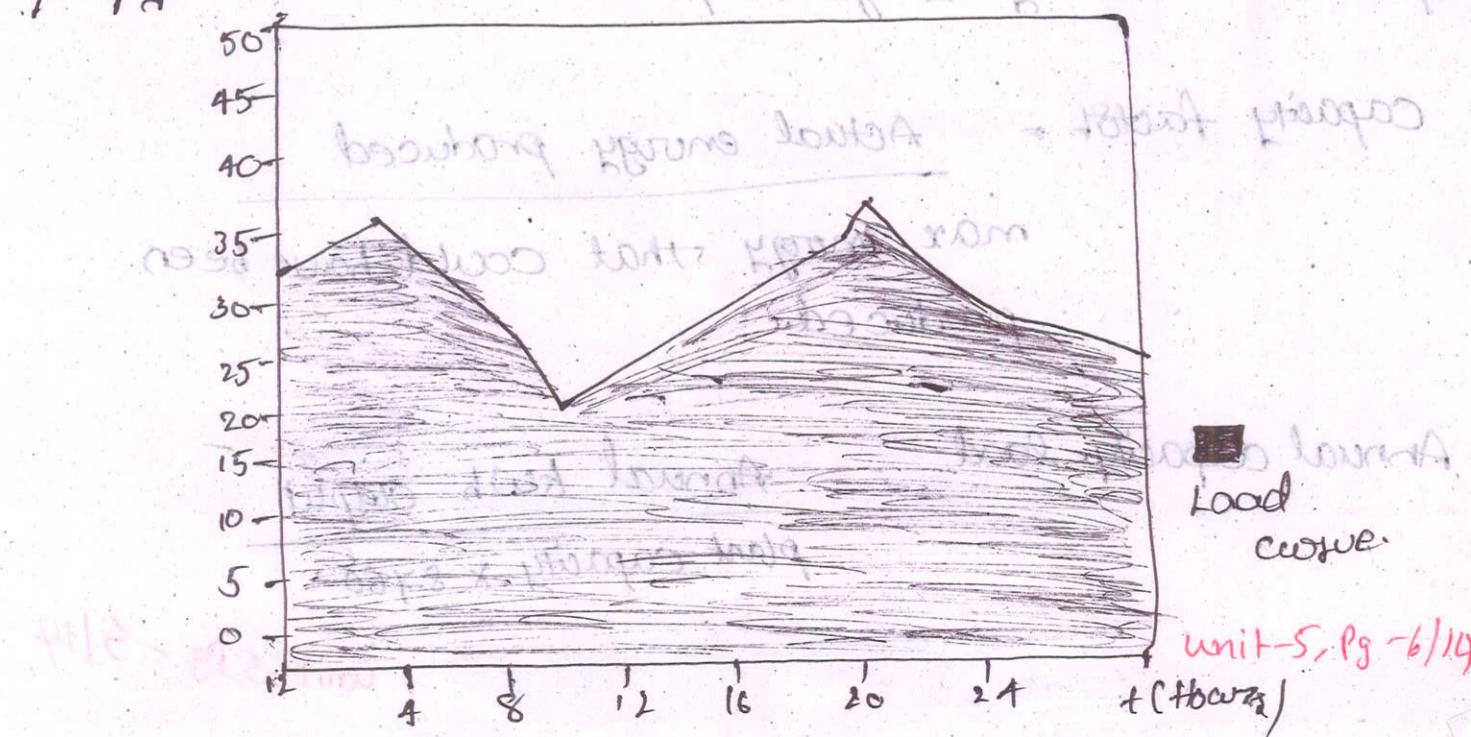
$$= \frac{7.35 \times 10^4}{(20 \times 10^3) \times 2190}$$

= 0.167

Plant Use Factor = 16.7%

Load Curve :-

The curve which shows the variation of load on the electrical power station with respect to time is known as load variation curve or simply load curve.



Importance of load Curve:-

- ⇒ The daily load curve gives the information of load on the power station during different running hours of the day.
- ⇒ The number of units generation per day is found from the area under the daily load curve.
- ⇒ Average load is found the load curve.
$$\Rightarrow \text{Average load} = \frac{[\text{Area (kwh)} \text{ under daily load curve}]}{24 \text{ hours}}$$
- ⇒ The maximum demand of the station on that day is found from the highest point of the daily load curve.
- ⇒ The size and the number of generating units can be determined from the load curve.
- ⇒ This load curve helps to determine the operation schedule of station. In that case when all the load units. unit-5 pg - 7/14

\Rightarrow Demand factor :-

The ratio of maximum demand and connected load on the power stations is called as demand factor.

$$\text{Demand factor} = \left[\frac{\text{maximum demand}}{\text{connected load}} \right]$$

\Rightarrow In the power station maximum demand & connected load

\Rightarrow Demand factor < 1

Demand factor is very important in determining the capacity of the plant equipment.

\Rightarrow Load factor :-

The ratio of Average load and the maximum demand in a given period of time in a power plant is known as Load factor.

$$\Rightarrow \text{Load factor} = \left[\frac{\text{Average load}}{\text{maximum demand}} \right]$$

\Rightarrow Load factor < 1

⇒ Capital and operating cost of different power plants :-

* Steam power plant cost :-

In recent days vast improvement have been made in generating electric power from steam.

About 0.45 kg of coal is need to produce

1kwh of electricity. It is observed that larger capacity power plants can utilize the thermal energy more efficiency than the smaller capacity plant.

A Steam power station may cost about 20\$ per kw of capacity. A typical sub-division of investment cost of steam power station follows

S.No	Investment	Cost in percentage
1	Turbo-generator & condenser	25%
2	load building & foundation	25%
3	Boiler plants	18%
4	fuel handling	6%
5	piping	5%
6	switch yard, switching & wiring	16%

Site Selection Criteria for power plant.

- * Availability of water:
 - * all other designs are based on it.
 - * water consumption is more as feed water into boiler, condenser and for ash disposal.
 - * water is required for drinking purpose.
 - * These details are required to decide the capacity of power plant.
 - * Hence plant should be located near water source.
- * Availability of Coal:
 - * power plant should be located near coal mines.
 - * A Thermal plant of 400M² capacity requires nearly 6000 tons of every day.

⇒ Pollution control technologies including waste control
disposal of Nuclear & coal power plants.

* Nuclear power plants:-

Nuclear waste:-

=> Nuclear waste are waste that contain radioactive material. Nuclear wastes are usually by-products of nuclear power generation and other applications of nuclear fission or Nuclear Technology.

Nuclear wastes classification

1) Solid wastes

2) Liquid wastes

3) Gaseous wastes

1) Liquid waste:

There are two ways

1) Dilution:

The liquid wastes are diluted with large quantities of water and then released into the ground. This method suffers from the

drawback that there is a chance of contamination of underground water known as "Dilution factor".

2) Concentration to small volume & storage:-

When the dilution of radioactive liquid wastes is not desirable due to amount of isotopes. The liquid wastes are concentrated to small volumes and stored in underground tanks.

* Gaseous waste:-

Gaseous wastes can mostly easily result in atmospheric pollution. Gaseous wastes are generally diluted with air, passed through filters and then released to atmosphere through large chimneys.

Solid waste:-

Solid wastes consists of scrap material & discarded objects contaminated with radioactive matter. These wastes if combustible are burnt and the radioactive matter is mixed with concrete, cemented and shipped for burial. Non-combustible solid wastes, are always buried deep in the ground.

\Rightarrow Pollution control technologies, including waste control of Thermal power plants:

Thermal power plants:

A generating station which converts heat energy of coal combustion into electrical energy is known as Thermal power station.

Pollution load from coal based Thermal power plant:

Pollutants	Emissions (in tons/day)
CO ₂	424650
particulate matter	4374
SO ₂	3311
NO _x	4968