Heat rates may be improved further through reheating and regeneration, but again the capital cost of additional equipment has to be balanced against gain in operating cost. The use of heat reclaiming devices, such as air pre-heaters and economisers, has to be considered from the point of economy in the consumption of fuel.

Internal Combustion Engine Plants

In this case also the selection of I.C. engines also depends on thermodynamic considerations. The efficiency of the engine improves with compression ratio but high pressures necessitate heavier construction of equipment which increases cost. The choice may also have to be made between four-stroke and two-stroke engines, the former having higher thermal efficiency and the latter lower weight and cost. The cost of the supercharger may be justified if there is a substantial gain in engine power which may balance the additional supercharger cost.

Gas Turbine Power Plant

The cost of the gas turbine power plant increases as the simple plant is modified by inclusion of other equipment such as intercooler, regenerator, re-heater, etc. but the gain in thermal efficiency and thereby a reduction in operating cost may justify this additional expense in first cost.

Hydro-electric Power Plant

As compared with thermal stations an hydro-electric power plant has little operating cost and if sufficient water is available to cater to peak loads and special conditions for application of these plants justify, power can be produced at a small cost. 171 The capital cost per unit installed is higher if the quantity of water is small Plant Economy . Also, the unit cost of conveying water to the power house is greater if the quantity of water is small. The cost of storage per unit is also lower if the quantity of water stored is large. An existing plant capacity may be increased by storing additional water through increasing the height of dam or by diverting water from other streams into the head reservoir. However, again it would be an economic study whether this additional cost of civil works would guarantee sufficient returns. Some hydro-power plants may be made automatic or remote controlled to reduce the operating cost further, but the cost of automation has to be balanced against the saving effected in the unit cost of generation.

Interconnected Hydro-steam System

In such a system where peak loads are taken up by steam units, the capacity of water turbine may be kept somewhat higher than the water flow capacity at peak loads, and lesser than or equal to maximum flow of river. This would make it possible for the water turbine to generate adequate energy at low cost during sufficient water flow

Advantages of Interconnection

Major advantages of interconnecting various power stations are :

(a) Increased reliability of supply.

(b) Reduction in total installed capacity.

(c) Economic operation.

(d) Operating savings.

(e) Low capital and maintenance costs.

(f) Peak loads of combined system can be carried at a much lower cost than what is possible with small individual system.

FACTORS AFFECTING ECONOMICS OF GENERATION AND DISTRIBUTION OF POWER

The economics of power plant operation is greatly influenced by :

(a) Load factor

(b) (b) Demand factor

(c) Utilisation factor

In a hydro-electric power station with water available and a fixed staff for maximum output, the cost per unit generated at 100% load factor would be half the cost per unit at 50% load factor. In a steam power station the difference would not be so pronounced since fuel cost constitutes the major item in operating costs and does not vary in the same proportion as load factor.

The cost at 100% load factor in case of this station may, therefore, be about 2/3rd of the cost 50% load factor. For a diesel station the cost per unit generated at 100% load factor may be about 3/4th of the same cost at 50% load factor. From the above discussion it follows that :

(a) Hydro-electric power station should be run at its maximum load continuously on all units.

(b) Steam power station should be run in such a way that all its running units are economically loaded.

(c) Diesel power station should be worked for fluctuating loads or as a stand by.

Demand Factor and Utilisation Factor

A higher efficient station, if worked at low utilisation factor, may produce power at high unit cost. The time of maximum demand occurring in a system is also important. In an interconnected system, a study of the curves of all stations is necessary to plan most economical operations. The endeavour should be to load the most efficient and cheapest power producing stations to the greatest extent possible. Such stations, called “base load stations” carry full load over 24 hours, i.e. for three shifts of 8 hours.

The stations in the medium range of efficiency are operated only during the two shifts of 8 hours during 16 hours of average load. The older or less efficient stations are used as peak or standby stations only, and are operated rarely or for short periods of time. Presently there is a tendency to use units of large capacities to reduce space costs and to handle larger loads. However, the maximum economical benefit of large sets occurs only when these are run continuously at near full load. Running of large sets for long periods at lower than maximum continuous rating increase cost of unit generated.

COST OF ELECTRICITY

A power plant should provide a reliable supply of electricity at minimum cost to the consumers / customers. The cost of electricity may be determined by the following: Fixed cost or capital cost and Operating costs. The total cost of energy produced is the sum total of fixed charges and operating charges.

Total cost = Fixed costs + Operating costs

Fixed cost or capital cost:

It is the cost required for the installation of the complete power plant. This cost includes 1. The cost of land, equipments, buildings, transmission and distribution lines cost of planning and designing the plant and many others. 2. Interest, 3. Depreciation cost, 4. Insurance, 5. Management costs, etc

1. The cost of land, equipments, buildings –

The cost of land and buildings does not change much with different types of power plants but the equipment cost changes considerably. The cost of buildings can be reduced by eliminating the superstructure on the oiler house and turbine house. To reduce the cost of equipment, unit system may be adopted, reduced by simplifying the piping system and elimination of duplicate system such as steam headers and boiler feed heaters.The cost of equipment or the plant investment cost is usually expressed on the basis of kW capacity installed. The per kWcapacity may not vary for various thermal power plant where as for hydro- electric power plant, it changes a lot because the cost of hydro-electric power plant depends on the foundation availability, types of dam, available head and spillways used.

2. Interest: -

the money needed or an investment may be obtained as loans, through bonds and shares. The interest is the difference between money borrowed and money returned. The rate of interest may be simple rate expressed as % per annum or may be compounded. A suitable rate of interest must be considered on the capital invested.