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A Review on Electrical Power System in India

Vijay Kumar Shukla

M.Tech Scholar, Dept. of Electrical Engineering, LPU, Jalandhar, Punjab

ABSTRACT

The Indian power sector is one of the most differentiated on the planet. Hotspots for power age range from business ones like coal, lignite, petroleum gas, oil, hydro and atomic power to other suitable non-regular sources like breeze, sunlight based, agribusiness and homegrown waste. The interest for power in the nation has been developing at a quick rate and is supposed to fill further in the years to come. To meet the rising necessity of power, enormous expansion to the introduced creating limit in the nation is required. The interest of power has been expanding persistently because of expanding populace, urbanization and utilization of innovation to get to familiar life. The Indian power area is going through a tremendous change that is rethinking the business standpoint. Supported monetary development keeps on driving power interest in India. The Government of India's concentration to accomplish 'Power For All' has sped up limit expansion in the country. Simultaneously, the power is expanding on both market side as well as supply side.

Keywords: Generation Capacity, Power Sector, system, electrical.

INTRODUCTION

Electric power supply system in a country comprises of generating units that produce electricity; high voltage transmission lines that transport electricity over long distances; distribution lines that deliver the electricity to consumers; substations that connect the pieces to each other; and energy control centers to coordinate the operation of the components. The Government of India has recognized the power area as a critical area of concentration to advance supported modern development. A portion of the drives taken by the Government of India to support the power area of India are as per the following: • India and Bhutan have marked a power project settlement to give a significant lift to the 600 MW Kholongchu hydroelectric task. It will be the primary hydroelectric task to be created by a joint endeavor (JV) between open area units (PSUs) of the two nations. • India and Nepal have consented to the power exchange arrangement (PTA). The arrangement will be compelling for the following 25 years and manages power exchange, cross-line transmission lines and matrix network. • The Ministry of New and Renewable Energy (MNRE) has started conspire for setting up of 25 Solar Parks, each with the limit of 500 MW or more, to be created over the course of the following 5 years in different states. • Indian Renewable Energy Development Agency Ltd (IREDA) has marked a MoU with the US Exim Bank regarding participation on clean energy speculation.

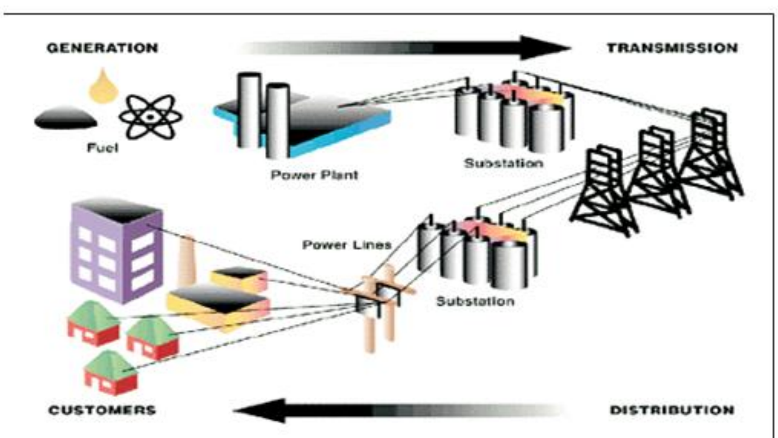


Figure 1: Typical Electric Power Supply Systems

Indian Power Sector is reliably confronting various difficulties of asset accessibility, fuel linkages, land obtaining, ecological clearances, unfortunate administration practices of past State Electricity Boards, conveyance plan for the supplies, deficiently prepared manpower. The power area job in the general development of the economy is becoming significant and basic. Any stoppage in its presentation seriously influences GDP development of the country all in all. The Figure 1 shows a simple electric supply system with transmission and distribution network and linkages from electricity sources to end-user.

POWER GENERATION PLANT

The fossil fuels such as coal, oil and natural gas, nuclear energy, and falling water (hydel) are commonly used energy sources in the power generating plant. A wide and growing variety of unconventional generation technologies and fuels have also been developed, including cogeneration, solar energy, wind generators, and waste materials.

About 70 % of power generating capacity in India is from coal based thermal power plants. The principle of coal-fired power generation plant is shown in Figure 2. Energy stored in the coal is converted in to electricity in thermal power plant. Coal is pulverized to the consistency of talcum powder. Then powdered coal is blown into the water wall boiler where it is burned at temperature higher than 1300°C. The heat in the combustion gas is transferred into steam. This high-pressure steam is used to run the steam turbine to spin. Finally turbine rotates the genera- tor to produce electricity.

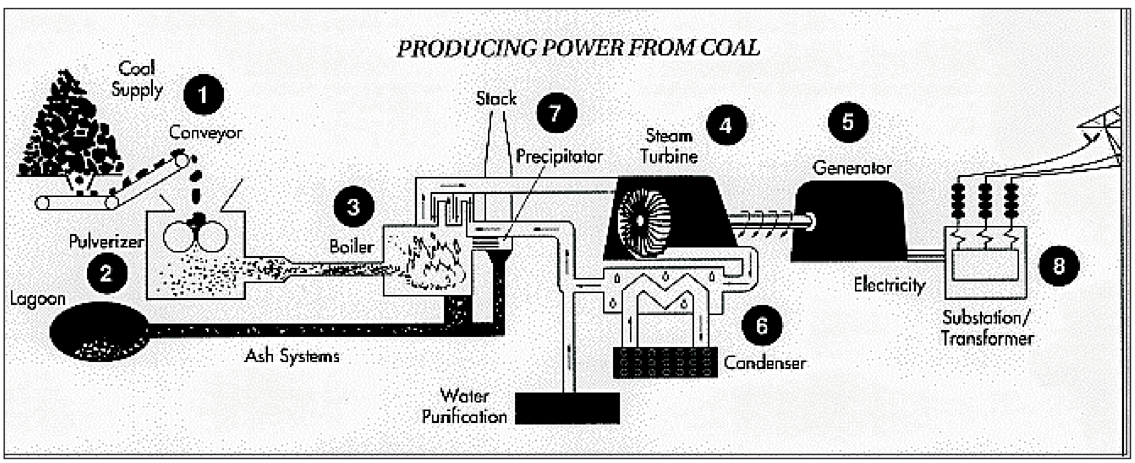


Figure 2: Principle of Thermal Power Generation

In India, for the coal based power plants, the general effectiveness goes from 28% to 35% relying on the size, functional practices and limit use. Where energizes are the wellspring of age, a typical term utilized is the "Intensity RATE" which mirrors the effectiveness of age. "HEAT RATE" is the intensity input in kilo Calories or kilo Joules, for creating 'one' kilo Watt-hour of electrical result. One kilo Watt hour of electrical energy being equiv-alent to 860 kilo Calories of nuclear power or 3600 kilo Joules of nuclear power. The "Intensity RATE" communicates in backwards the productivity of power age.

Overflow Efficiency

The essential capability of transmission and appropriation gear is to move power financially and dependably starting with one area then onto the next.

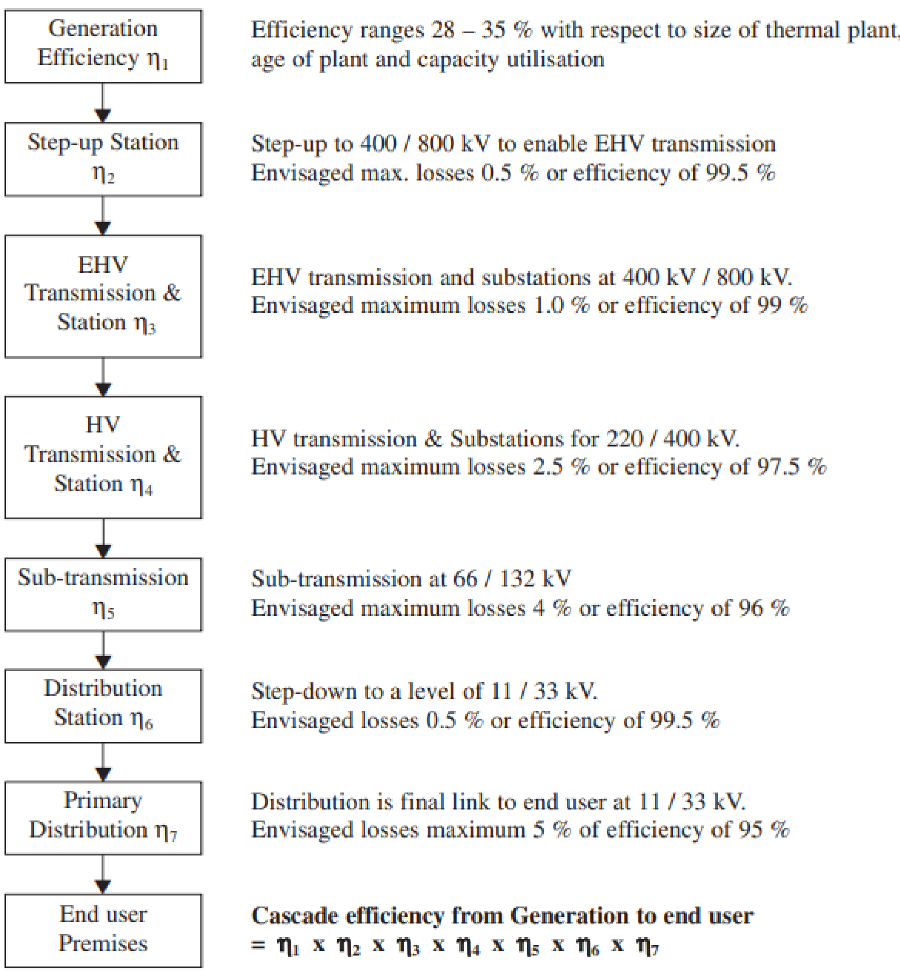
Transmitters as wires and links hung on pinnacles and shafts convey the high-volt-age, AC electric flow. An enormous number of copper or aluminum channels are utilized to frame the transmission way. The opposition of the significant distance transmission guides is to be limited. Energy misfortune in transmission lines is squandered as I2R misfortunes.

Capacitors are utilized to address power factor by making the ongoing lead the voltage. At the point when the AC flows are kept in stage with the voltage, working productivity of the system is kept up with at a significant level.

Circuit-interfering with gadgets are switches, transfers, circuit breakers, and wires. Every one of these gadgets is intended to convey and interfere with specific degrees of current. Making and breaking the mutt lease conveying guides in the transmission way with at least arcing is one of the main qualities of this gadget. Transfers sense unusual voltages, flows, and frequen-cy and work to safeguard the system.

Transformers are put at vital areas all through the system to limit power misfortunes in the T&D system. They are utilized to change the voltage level from low-to-high in sync up transformers and from high-to-low in sync down units.

The power source to end client energy productivity interface is a key variable, which impacts the energy input at the cause of supply. On the off chance that we consider the power stream from age to the client as far as fountain energy proficiency, run of the mill overflow productivity profile from age to 11 - 33 kV client industry will be as underneath:



Electricity Billing

The electricity charging by utilities for medium and enormous endeavors, in High Tension (HT) cate-bloody, is much of the time done on two-section duty structure, for example one section for limit (or interest) drawn and the second part for real energy drawn during the charging cycle. Limit or request is in kVA (clear power) or kW terms. The receptive energy (i.e.) kVArh drawn by the assistance is moreover recorded and charged for in certain utilities, since this would influence the heap on the utility.

Likewise, utility charges for greatest interest, dynamic energy and receptive power drawn (as reflected by the power factor) in its charging structure. What's more, other fixed and variable costs are additionally required.

The tax structure for the most part incorporates the accompanying parts:

a) Maximum request Charges
These charges connect with greatest interest enlisted during month/charging period and relating pace of utility.

b) Energy Charges
These charges connect with energy (kilowatt hours) consumed during month/charging period and comparing rates, frequently demanded in chunks of purpose rates. A few utilities currently charge based on obvious energy (kVAh), which is a vector amount of kWh and kVArh.

c) Power factor punishment or extra rates, as required by most utilities, are to contain receptive power drawn from matrix.

d) Fuel cost change charges as exacted by certain utilities are to change the rising fuel costs over a base reference esteem.

e) Electricity obligation charges exacted w.r.t units consumed.

f) Meter rentals

g) Lighting and fan power utilization is frequently at higher rates, demanded now and then on piece premise or on genuine metering premise.

h) Time Of Day (TOD) rates like pinnacle and non-top hours are additionally pervasive in tax structure arrangements of certain utilities.

i) Penalty for surpassing agreement interest

j) Surcharge in the event that metering is at LT side in a portion of the utilities

Examination of service charge information and checking its patterns helps energy administrator to recognize ways for power bill decrease through accessible arrangements in duty structure, aside from energy planning.

The utility utilizes an electromagnetic or electronic trivector meter, for the end goal of charging.

The base results from the electromagnetic meters are

- Greatest interest enlisted during the month, which is estimated in preset time between vals and this is reset toward the finish of each and every charging cycle.
- Dynamic energy in kWh during charging cycle
- Responsive energy in kVArh during charging cycle and
- Clear energy in kVAh during charging cycle

It is essential to take note of that while greatest interest is recorded, it isn't the quick interest drawn, as is in many cases misconstrued, however the time coordinated request over the predefined recording cycle.

ELECTRICAL LOAD MANAGEMENT AND MAXIMUM DEMAND CONTROL

Need for Electrical Load Management

In a full scale viewpoint, the development in the power use and variety of end use sections in season of purpose has prompted deficiencies in ability to satisfy need. As limit expansion is exorbitant and just quite a while prospect, better burden the board at client end assists with limiting pinnacle requests on the utility framework as well as better usage of power plant limits.

The utilities (State Electricity Boards) use power duty construction to impact end client in bet-ter load the executives through measures like season of purpose levies, punishments on surpassing permitted most extreme interest, night levy concessions and so on. Load the board is a powerful method for effi-ciency improvement both for end client as well as utility.

As the interest charges comprise a significant part of the power bill, from client point too there is a requirement for incorporated load the board to control the most extreme interest really.

Approach for Maximum Demand Control

1. Load Curve Generation

Introducing the heap interest of a buyer against time is known as a 'heap bend'. In the event that it is plotted for the 24 hours of a solitary day, it is known as an 'hourly burden bend' and on the off chance that day to day requests plotted north of a month, it is called everyday burden bends. A typi-cal hourly burden bend for a designing industry is displayed in Figure 1.5. These kinds of bends are helpful in foreseeing examples of drone, pinnacles and valleys and energy use pattern in a part or in an industry or in a dispersion network by and large.

2. Rescheduling of Loads

Rescheduling of huge electric burdens and gear tasks, in various movements can be arranged and executed to limit the synchronous most extreme interest. For this reason, it is advis-ready to set up an activity stream graph and a cycle diagram. Breaking down these outlines and with a coordinated methodology, it would be feasible to reschedule the tasks and running hardware so as to further develop the heap factor which thus lessens the most extreme interest.

3. Storage of Products/in process material/process utilities like refrigeration

It is feasible to diminish the greatest interest by developing stockpiling limit of items/materi-als, water, chilled water/boiling water, utilizing power during off top periods. Off top hour oper-ations additionally help to save energy because of ideal circumstances, for example, lower surrounding temperature and so on.

4. Shedding of Non-Essential Loads

At the point when the greatest interest will in general arrive at preset cutoff, shedding some of unimportant loads briefly can assist with decreasing it. It is feasible to introduce direct interest checking systems, which will turn off unnecessary burdens when a preset interest is reached. Straightforward systems give a caution, and the heaps are shed physically. Modern chip controlled systems are likewise accessible, which give a wide assortment of control choices like:

- Exact forecast of interest
- Graphical showcase of present burden, accessible burden, request limit
- Visual and perceptible alert
- Programmed load shedding in a foreordained grouping
- Programmed reclamation of burden
- Recording and metering

5. Operation of Captive Generation and Diesel Generation Sets

At the point when diesel age sets are utilized to enhance the power provided by the electric utilities, interfacing the D.G is prudent. Sets for terms when request arrives at the pinnacle esteem. This would decrease the heap interest to an impressive degree and limit the interest charges.

6. Reactive Power Compensation

The greatest interest can likewise be decreased at the plant level by utilizing capacitor banks and keeping up with the ideal power factor. Capacitor banks are accessible with chip based control systems. These systems switch on and off the capacitor banks to keep up with the ideal Power factor of system and advance greatest interest accordingly.

POWER FACTOR IMPROVEMENT AND BENEFITS

Power factor Basics

In all modern electrical dispersion systems, the significant burdens are resistive and inductive. Resistive burdens are radiant lighting and obstruction warming. In the event of unadulterated resistive burdens, the voltage (V), current (I), opposition (R) relations are directly related, for example

$$\mathbf{V = I \times R \text{ and Power (kW)} = V \times I}$$

Typical inductive loads are A.C. Motors, induction furnaces, transformers and ballast-type lighting. Inductive loads require two kinds of power: a) active (or working) power to perform the work and b) reactive power to create and maintain electro-magnetic fields.

Active power is measured in kW (Kilo Watts). Reactive power is measured in kVAr (Kilo Volt-Amperes Reactive).

The vector sum of the active power and reactive power make up the total (or apparent) power used. This is the power generated by the SEBs for the user to perform a given amount of work. Total Power is measured in kVA (Kilo Volts-Amperes).

The ratio of kW to kVA is called the power factor, which is always less than or equal to unity. Theoretically, when electric utilities supply power, if all loads have unity power factor, maximum power can be transferred for the same distribution system capacity. However, as the loads are inductive in nature, with the power factor ranging from 0.2 to 0.9, the electrical dis- tribution network is stressed for capacity at low power factors.

Improving Power Factor

The solution to improve the power factor is to add power factor cor- rection capacitors to the plant power distribution sys- tem. They act as reactive power generators, and provide the needed reactive power to accomplish kW of work. This reduces the amount of reactive power, and thus total power, generated by the utilities.

CONCLUSION

In this paper the Indian Power Scenario is discussed. Despite the growth in supply, the country is still facing major challenges in providing electricity access to all the households and also improving reliability and quality of power supply. Its power systems are struggling to overcome power shortages and poor power quality. The major constraint in achieving the target is shortage of capital resources. Shortages are exacerbated by inefficiencies in power generation, distribution and end-use systems. There is an immediate need for change in planning strategies from the traditional approach of increasing generation to meet in disciplined consumption to need, resource and conservation based approach for economic and environmental benefits. Considering the scale of the target, multipronged strategies are envisaged. Some of these are partial solution for power shortages, yet these are important measures in context of resource crunch since these would enable reducing the requirement for new generating capacity. These include removing obsolescence, optimum utilization of existing assets, reducing transmission and distribution losses, demand side management through greater conservation of electrical energy, policy changes in pricing mechanism, shift and emphasis on renewable energy sources for power generation, total energy systems, new energy storage systems like Superconducting Magnetic Storage Systems as spinning reserve to meet peak demand and energy efficiency promotions in accordance with national and socioeconomic and environmental priorities. Steps which may help large scale integration of renewable power with conventional power generation are also enumerated.

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