

Basic structure of electric system

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An electric power system is a network of electrical components deployed to supply, transfer, and use electric power. An example of a power system is the electrical grid that provides power to homes and industries within an extended area. The electrical grid can be broadly divided into the generators that supply the power, the transmission system that carries the power from the generating centers to the load centers, and the distribution system that feeds the power to nearby homes and industries.

Smaller power systems are also found in industry, hospitals, commercial buildings, and homes. A single line diagram helps to represent this whole system. The majority of these systems rely upon three-phase AC power--the standard for large-scale power transmission and distribution across the modern world. Specialized power systems that do not always rely upon three-phase AC power are found in aircraft, electric rail systems, ocean liners, submarines, and automobiles.

In recent times, many important developments have come from extending innovations in the information and communications technology (ICT) field to the power engineering field. For example, the development of computers meant load flow studies could be run more efficiently, allowing for much better planning of power systems. Advances in information technology and telecommunication also allowed for effective remote control of a power system's switchgear and generators.

Electric power is the product of two quantities: current and voltage. These two quantities can vary with respect to time (AC power) or can be kept at constant levels (DC power).

Solid-state devices, which are products of the semiconductor revolution, make it possible to transform DC power to different voltages, build brushless DC machines and convert between AC and DC power. Nevertheless, devices utilising solid-state technology are often more expensive than their traditional counterparts, so AC power remains in widespread use.

Depending on how the poles are fed, alternating current generators can produce a variable number of phases of power. A higher number of phases leads to more efficient power system operation but also increases the infrastructure requirements of the system. Electricity grid systems connect multiple generators operating at the same frequency: the most common being three-phase at 50 or 60 Hz.

Conductors carry power from the generators to the load. In a grid, conductors may be classified as belonging to the transmission system, which carries large amounts of power at high voltages (typically more than 69 kV) from the generating centres to the load centres, or the distribution system, which feeds smaller amounts of power at lower voltages (typically less than 69 kV) from the load centres to nearby homes and industry.

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Choice of conductors is based on considerations such as cost, transmission losses and other desirable characteristics of the metal like tensile strength. Copper, with lower resistivity than aluminum, was once the conductor of choice for most power systems. However, aluminum has a lower cost for the same current carrying capacity and is now often the conductor of choice. Overhead line conductors may be reinforced with steel or aluminium alloys.

Conductors in exterior power systems may be placed overhead or underground. Overhead conductors are usually air insulated and supported on porcelain, glass or polymer insulators. Cables used for underground transmission or building wiring are insulated with cross-linked polyethylene or other flexible insulation. Conductors are often stranded for to make them more flexible and therefore easier to install.

Conductors are typically rated for the maximum current that they can carry at a given temperature rise over ambient conditions. As current flow increases through a conductor it heats up. For insulated conductors, the rating is determined by the insulation. For bare conductors, the rating is determined by the point at which the sag of the conductors would become unacceptable.

Reactors consume reactive power and are used to regulate voltage on long transmission lines. In light load conditions, where the loading on transmission lines is well below the surge impedance loading, the efficiency of the power system may actually be improved by switching in reactors. Reactors installed in series in a power system also limit rushes of current flow, small reactors are therefore almost always installed in series with capacitors to limit the current rush associated with switching in a capacitor. Series reactors can also be used to limit fault currents.

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