The transmission system moves electricity at the speed of light from power plants where it is produced to communities where it is used. The transmission system carries large amounts of high-voltage electricity at the wholesale level. The voltage is then reduced at substations to levels safe for distribution to homes and businesses at the retail level.

What Is the Transmission System?

The transmission system makes it possible to efficiently transport large amounts of power over long distances. Without transmission, electricity would have to be produced close to where it is used.

Generators produce electricity, which is then increased to high voltage by transformers and sent to transmission lines. The transmission system moves the electricity over long distances to local distribution systems, where it is transformed to a lower voltage, so it can be safely delivered to consumers.

One way to think about this system is in terms of an interstate road trip. A driver starts the trip on local roads and then uses an on-ramp to join the faster-flowing traffic on the interstate highway. At the end of the journey, the driver uses an off-ramp to join a local road system, slowing down from highway speed to reach the destination.

At a Glance

- Transmission refers to the movement of electricity from generators to consumers.
- Generated power is stepped up to high voltages for transmission.
- Large towers and poles carry the electricity over long distances.
- When electricity reaches its destination, it is stepped down to lower voltages.
- The lower-voltage electricity then enters the distribution system to reach homes and businesses.

Generated Power Steps Up to the Transmission System

Transmission begins at generating stations that produce electricity with voltages ranging from 2,300 to 24,000 volts. In switchyards, or substations, outside of these generating stations, there are large transformers that raise, or "step up," the voltage to levels suitable for transporting large amounts of power at the transmission level – 100 kV (100,000 volts) and higher. PJM, as a regional transmission organization, is responsible for overseeing transmission at 100 kV and above.

Transmission Lines Move Electricity Over Long Distances

Electricity is transmitted from one point to another by conductors, which are made up of many strands of aluminum and steel wire. Interconnected transmission lines form a network; therefore, if one line fails, others can take up the load.

Most of the North American transmission system operates on alternating current (AC). These AC transmission lines carry three-phase current – three separate streams of electricity traveling through separate conductors. Transmission towers generally support at least three wires, sometimes bundled with six conductors, if they carry two circuits on the same pole or tower.

Consumers may recognize transmission lines as the larger, taller poles and towers. These carry many wires over long distances and differ from the utility poles found on a local street. These smaller utility poles and lines are part of the distribution system – the final leg in electricity's journey from generators to consumers.

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High-Voltage Electricity Steps Down for Consumption

Wholesale power is transmitted at voltages that are too high for business and residential use. A series of step-down transformers that reduce voltage for distribution are the counterpart to the step-up transformers that raise voltage as power emerges from the generating station.

When electricity approaches its destination, it is routed through large transformers in substations. These transformers reduce, or "step down," the voltage to levels suitable for distribution to consumers at the retail level. In this step, the power that is over 100 kV from the transmission lines is reduced to voltages ranging from 4,160 to 34,500 volts.

What Else Happens in a Substation?

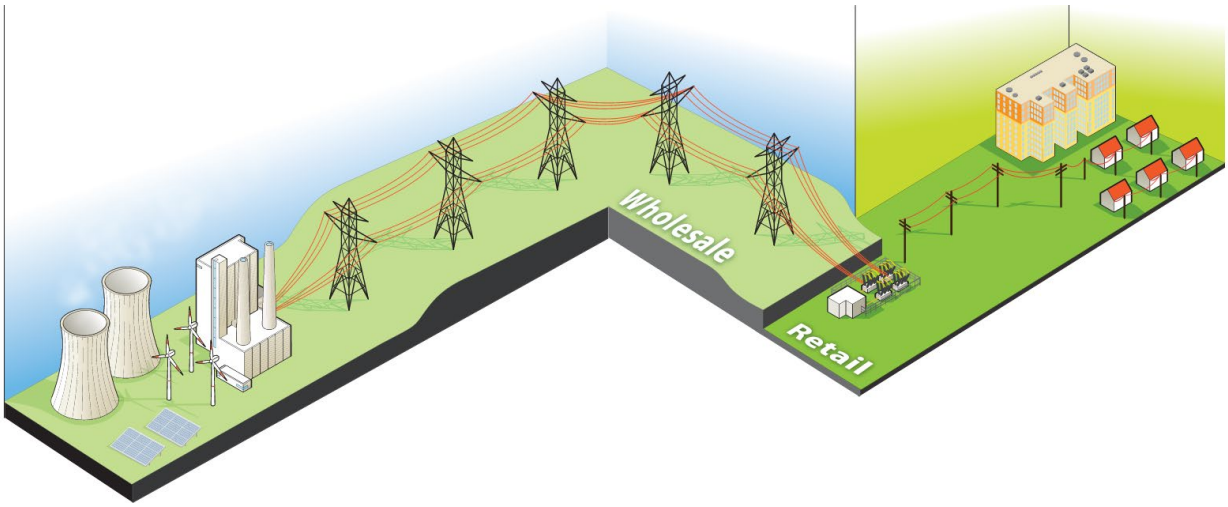
Substations also contain other devices such as circuit breakers, switches, meters, relay protection and control devices – all connected by hundreds of wires. Devices called regulators, for example, react to changes in customer demand to help maintain steady voltage.

Successful operation of the electric grid requires the continuous balance of the power being supplied and consumed. Many substations use a capacitor bank to boost the voltages to counteract or correct imbalances in the supply and demand.

From Substations to Consumers

Conductors or cables, commonly known as distribution feeders, leave substations in various directions, carrying power to local distribution points at the retail level. Distribution transformers then reduce the voltage further for use by homes and businesses. Standard voltage at the consumer level is 120 or 240 volts.

The transmission system is an essential part of the bulk electric system. Without the ability to move electricity across long distances, each community would have to depend on power generated locally. A robust transmission system gives different geographic areas access to power from distant generators, regardless of their location.



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