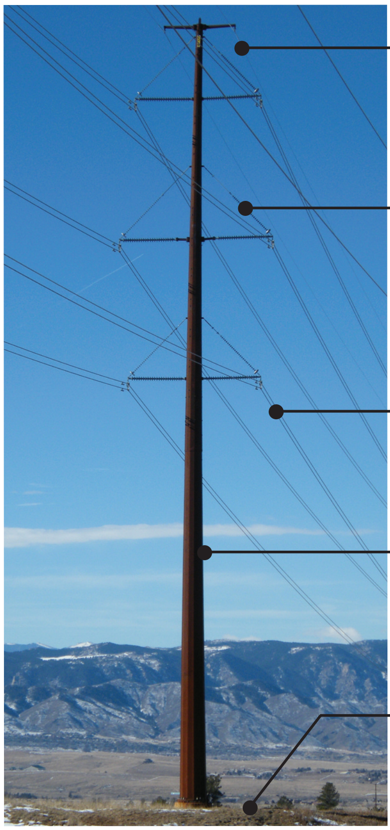
Transmission Line Infrastructure

How do the pieces fit together?

The conductors are attached to the structures by insulators that prevent contact between the conductor and the structure because contact between the two could result in a short circuit, potentially interrupting the power supply. The foundation, structure and insulators must be strong enough to support the weight of the conductor and any wind and ice loads. Shield wires attached to the top of the structures provide protection against lightning strikes, minimizing the possibility of storm-related outages.



Terms to know

Conductor: A wire made up of multiple aluminum strands around a steel core that together carry electricity. A bundled conductor is two or more conductors connected to increase the capacity of a transmission line.

Circuit: A continuous electrical path along which electricity can flow from a source, like a power plant, to where it is used, like a home. A transmission circuit consists of three phases with each phase on a separate set of conductors.

Phase: One element of a transmission circuit that has a distinct voltage and current. Each phase has maximum and minimum voltage peaks at different times than the other phases.

Double circuit: Two independent circuits on the same structure with each circuit made up of three sets of conductors.

Shield wire: A wire connected directly to the top of a transmission structure to protect conductors from a direct lightning strike, minimizing the possibility of power outages.

Structures: Towers or poles that support transmission lines.

Insulator: An object made of a material, such as glass, porcelain or composite polymer, that is a poor conductor of electricity. Insulators are used to attach conductors to the transmission structure and to prevent a short circuit from happening between the conductor and the structure.

Right-of-way: Land area legally acquired for a specific purpose, such as the placement of transmission facilities and for maintenance access.

Substation: A facility that monitors and controls electrical power flows, uses high voltage circuit breakers to protect power lines and transforms voltage levels as needed to further distribute the energy into the electrical grid.

Transmission line characteristics

The conductor, structure type, configuration, right-of-way parameters and other design characteristics of the proposed 345 kilovolt (kV) lines will be considered by the Colorado Public Utilities Commission during the Certificate of Public Convenience and Necessity (CPCN) process.

In addition to line voltage (i.e. 345 kV), typical determining factors in deciding the type and configuration of a structure are conductor number and size, wind or ice loads, terrain, structure spacing, right-of-way width and existing buildings adjacent to the corridor for the proposed lines.

345 kV line characteristics

CONDUCTOR. Each phase would consist of bundled aluminum stranded, steel core conductor sized to carry the appropriate amount of electricity.

STRUCTURES. For 345 kV double circuit lines, single steel poles are suitable.

Single pole structures are made of self-weathering or galvanized steel and placed on concrete foundations. Double circuit structures vary from 90 to 170 feet. Spans (or distance) between structures range from 800 to 1,300 feet.

RIGHT-OF-WAY. A double circuit 345 kV line typically requires a 100 to 150-foot right-of-way. A narrower right-of-way may be acceptable where a transmission line is located adjacent to a pre-existing line, road or pipeline corridor.

Underground lines

The proposed Pawnee-Daniels Park 345 kV transmission line project calls for overhead lines. Underground lines usually are used only in heavily congested urban areas and when there is no viable overhead corridor, such as near an airport. Lines normally are buried only for short distances.

The biggest difficulties with burying lines are cost and the time required to make repairs if there are failures. An equivalent underground line can cost 10 to 20 times more than the amount of an overhead line, and it creates technical and operational challenges. Significantly more time is necessary to locate and diagnose a problem on an underground line, and repairs can disrupt service for several weeks. Installing underground lines also can have a considerable environmental impact.

Underground transmission line construction