CapX2020

Delivering electricity you can rely on

Central Minnesota Municipal Power Agency
Dairyland Power Cooperative
Great River Energy
Minnesota Power
Minnkota Power Cooperative
Missouri River Energy Services
Otter Tail Power Company
Rochester Public Utilities
Southern Minnesota Municipal Power Agency
WPPI Energy
Xcel Energy

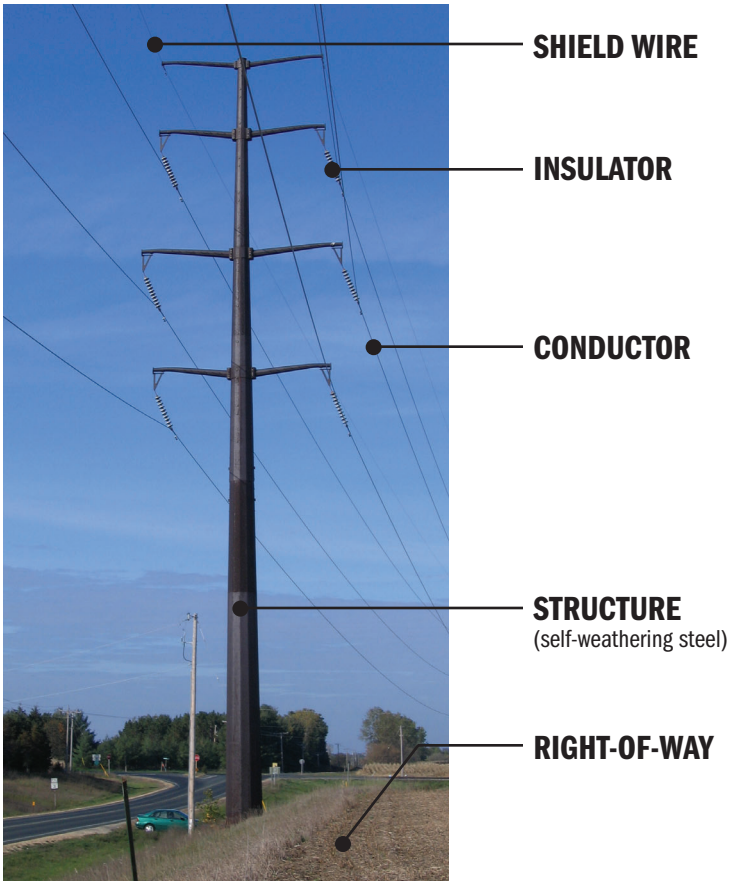
CapX2020 transmission line infrastructure

CapX2020 projects

Bemidji-Grand Rapids 230 kV
Fargo-St. Cloud 345 kV
Monticello-St. Cloud 345 kV
Hampton-Rochester-La Crosse 345 kV
Brookings County-Hampton 345 kV
Big Stone South-Brookings County 345 kV

How do the pieces fit together?

Conductors are attached to structures by insulators that prevent contact between the conductor and structure, as contact between the two could result in a short circuit, potentially disrupting the power supply. The foundation, structure and insulators must be strong enough to support the weight of the conductor, 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 composed 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's 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.

Single circuit: A circuit with three sets of conductors.

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 like 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.

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CapX2020 transmission line characteristics

The conductors, structure type, configuration, right-of-way and other design characteristics of a 345 kV line is considered by the South Dakota Public Utilities Commission and other relevant regulatory bodies in Minnesota, North Dakota and Wisconsin as part of the approval process.

In addition to line voltage, typical determining factors in deciding structure type and configuration are conductor number and size, wind or ice loads, terrain, structure spacing, right-of-way and existing buildings adjacent to the line corridor.

345 kV line characteristics

CONDUCTORS. Each phase consists of bundled aluminum stranded, steel core conductors sized to carry the appropriate amount of electricity. The same conductor and bundled configuration will be used for all CapX2020 345 kV single circuit and double circuit transmission lines.

STRUCTURES. For 345 kV lines, single steel poles are suitable for single or double circuits; wooden or steel H-frame structures can be used for single circuits.

Single pole structures are made of self-weathering or galvanized steel and placed on concrete foundations. Single circuit steel poles vary in height from 120 to 150 feet; double circuit structures vary from 140 to 170 feet. Distance between structures ranges from 800 to 1,000 feet.

H-frame structures are two wood or steel poles with wood or steel cross bracing and conductor supports. They can be embedded in the ground without a foundation and vary in height from 100 to 150 feet, depending on the span between structures. These structures are suitable only for single circuit configurations.

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

H-frame structure

Single circuit single pole structure

Double circuit single pole structure