

CapX2020

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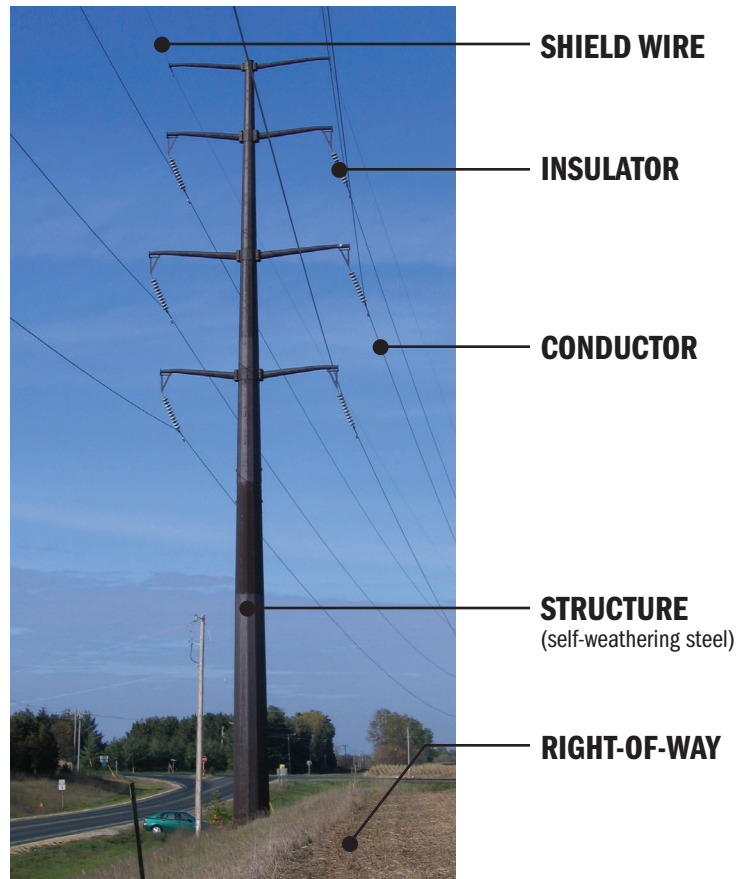
CapX2020 Proposed Transmission Line Infrastructure

CapX2020 Group 1 proposed projects

Bemidji-Grand Rapids (230-kV)
 Fargo-Alexandria-St. Cloud-Monticello (345-kV)
 Hampton-Rochester-La Crosse (345-kV)
 Brookings County-Hampton (345-kV)

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.

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.

Proposed CapX2020 transmission line characteristics

The conductors, structure type, configuration, right-of-way parameters and other design characteristics of the 345-kilovolt (kV) and 230-kV lines proposed by CapX2020 will be considered by the Minnesota Public Utilities Commission and other relevant regulatory bodies in Wisconsin, North Dakota and South Dakota, as part of the approval process. The characteristics of any associated 161-kV lines will be decided by either the relevant state regulatory agency or a local governmental authority.

In addition to line voltage (i.e. 345-kV, 230-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.



Transmission substation



H-frame structure



Single circuit single pole structure



Double circuit single pole structure

345-kV line characteristics

CONDUCTORS. Each phase would consist of bundled aluminum stranded, steel core conductors sized to carry the appropriate amount of electricity. CapX2020 proposes that the same conductor and bundled configuration be used for all of the 345-kV single circuit and double circuit transmission lines in the Group 1 projects.

STRUCTURES. For 345-kV lines, single steel poles are suitable for single or double circuits and 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 and double circuit structures vary from 140 to 170 feet. Spans (or distance) between structures range from 800 to 1000 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 wide 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.

230-kV line characteristics

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

STRUCTURES. For 230-kV lines, single steel poles are suitable structures for single or double circuits and wooden or steel H-frame structures can be used for single circuits. Single circuit steel poles vary in height from 75 to 120 feet and double circuit steel poles vary from 95 to 145 feet. Spans between structures range from 600 to 900 feet. H-frame structures for 230-kV lines vary in height from 90 to 120 feet, depending on the span between structures.

RIGHT-OF-WAY. A 230-kV line typically requires a 125-foot right-of-way.

Why don't the CapX2020 proposals include underground lines?

The proposed CapX2020 Group 1 projects call 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 – a few miles at a time.

The two biggest difficulties with burying lines are cost and the time required to make repairs if there are failures. An equivalent underground line can cost more than 10 times 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 extended periods. Installing underground lines also can have a considerable environmental impact.