Xcel Energy®

Frequently Asked Questions about Electric Transmission

Why does the electric transmission grid need to be expanded?

The simple answer: Because we're using more electricity than we did just a few years ago – and our use expected to grow another 40 percent by 2030 (U.S. Energy Information Administration). Our demand for electricity has risen in proportion both to the growing number of electronic items and appliances we depend on and to the increasing size of our homes. For example, today, 99 percent of U.S. households own a TV -- two-thirds have three or more! All homes (both new and existing) have more electric appliances that ever before. In 1970, 30 percent of homes had an electric clothes dryer; in 2007, that number nearly tripled to 80 percent of households. Additionally, more than 80 percent of Americans have a cell phone and most are recharged daily (CEA consumer survey).

How is electricity delivered to consumers?

Transformers at a generating plant increase the voltage up to a transmission voltage (69 kV, 115 kV, 230 kV, 345 kV, etc.) so it can travel long distances over high-voltage transmission lines. Transmission lines carry the electric energy from these generating plants to the places where electricity is used.

Are transmission lines safe?

Yes. Every effort is made to ensure safety in construction, operation and maintenance of transmission lines. The lines and line infrastructure are designed to withstand extreme weather conditions. Protective devices at line terminals stop the electricity flow under any abnormal operating circumstances. Utility practices meet or exceed standards set by national electric safety codes as well as those adopted by local governments.

What's the difference between a single circuit and double circuit transmission line?

A single circuit transmission line has three sets of conductors, while a double circuit transmission line has two independent circuits on the same structure with each circuit made up of three sets of conductors.

What is a conductor?

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

What is an insulator?

An insulator is an object made of a material like glass, porcelain, or composite polymer that is a poor conductor of electricity. They are used to attach conductors to the transmission structure and to prevent a short circuit from happening between the conductor and the structure.

What is shield wire?

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

How do these 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 results 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.

What is an easement?

An easement is a permanent right authorizing a person or party to use the land or property of another for a particular purpose. In this case, a utility acquires certain rights to build and maintain a transmission line. Landowners are paid a fair price for the easement and can continue to use the land for most purposes, although some restrictions are included in the agreement. The easement instrument is the legal document that must be signed by the landowner before the utility can proceed.

What is a right-of-way and how does it differ from an easement?

A right-of-way is the actual land area acquired for a specific purpose, such as a transmission line or roadway. In simplest terms, an easement is a land right and a right-of-way is the physical land area upon which the facilities (transmission line, roadway, buildings, etc.) are located.

How do the costs compare between overhead and underground transmission lines?

The materials and construction methods required for underground transmission lines lead to more costly projects. Generally, burying transmission lines cost 10 to 20 times more than the cost to build overhead transmission lines. Because the costs associated with new and existing transmission lines are passed along to retail electric customers in their monthly electric bill, various state commissions that regulate Xcel Energy's operating companies determine during their review of projects whether it is prudent to place part or all of a transmission lines project underground. In some instances, transmission lines have been placed underground where there is an entity, such as a city or a developer, willing to pay the additional cost to bury the lines. In either case, specific construction measures are necessary for safe and reliable operation of the line.

How do overhead and underground transmission lines differ in reliability?

Underground lines are less subject to outages from lightning strikes than overhead lines; however, when an underground line fails or is damaged, it can take weeks or months to locate and repair, while overhead lines can be repaired in hours or days. Underground lines are contained in a cable vault or duct, so when a fault occurs, that energy is contained and causes damage. With overhead lines, the energy is dissipated into open space, minimizing the amount of damage. Locating and accessing underground damage also is an issue. While a broken conductor or damaged insulator should be plainly visible on an overhead line, it will not be apparent on the underground circuit. Xcel Energy needs special equipment to determine the exact location of the cable fault. Depending on the location, the duct bank or cable vault may need to be excavated in order to pull the cable or install splices.

How do underground transmission lines differ from overhead ones operationally?

From an operational perspective, all electric lines produce heat and therefore have a limit on the amount of power they can carry to prevent overheating. Underground lines cannot dissipate heat as well as overhead lines. So, it would be rare that Xcel Energy would agree to bury major transmission lines on its system, such as our 345 kV and 500 kV lines, because of this limitation and potential operational issues that could affect the overall reliability of the transmission system.

How do overhead and underground transmission lines differ on environmental impacts?

While there is some belief that placing transmission lines underground and out of sight is better for the environment, underground transmission lines can't be simply plowed into the ground. They need to be encased in conduits, which are usually built with concrete and require large trenches and bores along the entire route of the line, which is invasive and disruptive – especially when there are wetlands and streams that need to be crossed. Access points for the underground line also need to be placed at regular intervals in order to inspect and repair buried cable. And an access road would be required along the length of the route. If oil-filled cable is required, there is the potential for oil leaks and the need to have pressure stations along the route.

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