

# Underground transmission lines

Underground **transmission** cables can be an alternative to the more common above ground transmission lines. AltaLink will consider the use of underground transmission technology on a project by project basis. Placing transmission cables underground is generally only considered when above ground is not a viable option or in areas of high population density. Ultimately the Alberta Utilities Commission (AUC) would have to approve the use of underground in each circumstance.

## Cost

Underground solutions are typically more expensive than above-ground options. As a regulated utility we must ensure that we are responsible with our costs, as they affect every ratepayer in Alberta. Underground solutions are usually only undertaken when a third party - such as a developer - pays the extra cost incurred. Below are examples outlining why underground transmission cables are typically more expensive.

Materials for underground transmission are more expensive because:

- more costly insulation is used – overhead lines are suspended from **insulators** at each structure, most underground cables are entirely coated with high purity polymers for insulation
- more time and more complex equipment is required to manufacture underground cables – overhead lines are essentially wires made of layers of aluminum strands wrapped around a steel cable, underground cables are made of multiple layers of copper and insulating materials
- larger cables are needed to carry the same amount of power as the wires of an overhead line because underground cables heat up more than overhead wires which are cooled by the surrounding air
- double the number of cables may be needed to match the power capacity of the wires on an equivalent overhead line

Installing underground transmission cables is labour and equipment intensive and more expensive because:

- linear trench excavations are needed along the entire route
- underground transmission cables must be installed in concrete ducts
- large splicing vaults are needed every 500 to 1,000 metres to join underground cables, which are limited in length due to weight restrictions during transportation
- the larger size and increased number of cables requires more intensive installation

### DEFINITION

#### Transmission

Transmission lines transport large amounts of power over long distances across the province. AltaLink's transmission lines range from 69 kV (69,000 volts) to 500 kV (500,000 volts). Light bulbs typically range from 120 to 300 volts.

### DEFINITION

#### Insulator

The ceramic piece that holds the wire to the structure.

*Underground transmission technology is continually evolving. Although we attempt to ensure the information provided in this one pager is technically accurate, it is subject to change.*

## CONTACT US

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**ALTALINK**

DEFINITION

**Voltage**

Electrical pressure, the potential to do work.

DEFINITION

**Conductor**

A material through which electric current flows easily - often referred to as wires.

DEFINITION

**Current**

The movement of electric charge.



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## Safety

There are risks associated with working near any kind of power line. However, underground cables are generally less hazardous to workers and the public because they are insulated, surrounded by a shield and typically buried about one to three metres deep within a concrete duct. Overhead lines can be hazardous if the structures/wires fall to the ground and/or are inadvertently contacted.

## Right-of-way

If an underground cable is placed beneath an urban road then the right-of-way would be the road itself. If the underground cable is not following a roadway, the right-of-way would be based on the amount of space needed for construction activities to safely take place, usually about 10 to 15 metres in width. An easement agreement would be required to ensure vehicle access and prevent changes in surface grade or the construction of buildings.

Overhead transmission line right-of-ways are approximately 60 metres for 240 kV or 500 kV and approximately 20 metres for 69 kV or 138 kV.

## Reliability

In general, overhead lines experience more failures than underground cables, but can be repaired more quickly because the damage is easily accessible. Because underground solutions are less accessible, repair times can range from days to months, depending on the voltage and capacity.

## Environment

Placing a cable underground would involve more disruption to the environment during construction than an overhead option. Underground cable placement requires soil stripping, continuous trenching and placing underground splicing vaults periodically to connect (splice) two cable ends.

Overhead transmission line construction is more concentrated to the specific structure locations. Also, overhead transmission lines span long distances between structure locations (approximately 300 to 400 metres for 240 kV or 500 kV and about 150 metres for 69 kV or 138 kV). The area between structures is virtually untouched after construction is complete.

## Electric and magnetic fields

Electric Fields (EFs) are caused by the **voltage** of the transmission line **conductor** (wire). The insulation and shielding required for underground cables effectively blocks EFs. As overhead transmission lines do not have insulation, EFs can be measured near these lines.

Magnetic Fields (MFs) are caused by the flow of electrical **current** through transmission line conductor (wire) and cannot be shielded by insulation, cement or earth. MFs can be measurable near both underground and overhead transmission lines. MFs are greatest close to the source and decrease as the distance increases. The net result is that MFs can be higher directly above underground cables than directly under overhead lines carrying the same current. Because MFs are caused by current, and not voltage, MFs can also be higher near a lower voltage transmission line that may be closer to the ground and/or carrying more current.