



## Multiple factors can affect the reliability and security of underground and overhead transmission lines

### UNDERGROUND LINES VS OVERHEAD LINES

#### OUTAGE DURATION

Outages can last days or weeks depending on the time it takes to mobilize crews, obtain the appropriate equipment, locate the issue and complete repairs underground.

Outages can last hours or a few days. Crews can identify issues more quickly and easily. Materials needed to conduct overhead repairs are also more readily available.

#### REPAIR PROCESS

Isolating and fixing the problem can take a while. The process generally involves opening a manhole, locating the fault, removing the failed equipment, pulling in new cable and splicing the cable back together. Typically, the area within the right-of-way is not repaired or visually pleasing for some time.

Repairing overhead lines is less invasive since damaged equipment is easier to identify and access.

#### LIFE EXPECTANCY

Typically last about 40-50 years.

Typically last about 60+ years.

#### WEATHER

Not exposed to harsh conditions such as snow, ice, wind and thunderstorms. However, still vulnerable to damage from earthquakes and flooding.

More vulnerable to damage from snow, ice, wind, thunderstorms and other inclement weather.

#### OTHER HAZARDS

Less prone to damage from animals, tree branches and vehicle collisions. They are also less susceptible to excavation damage by a third party when they are co-located with other underground utilities. Contractors are likely to exercise more caution when they know multiple underground utilities are located in the same area.

More likely to experience damage from animals, tree branches and vehicle collisions.

### MYTH:

Crews can use the same type of line for overhead and underground transmission construction.

### FACT:

Underground transmission cables are much bigger than overhead cables. Overhead cables have the benefit of the air to help cool the conductor. Underground cables require an outer protective jacket, shielding and insulation to keep the conductor cool.

Overhead conductor (left) compared with underground cable (right).



### MYTH:

If a transmission line is underground, that frees up space above the ground for activities like building a shed or planting a tree.

### FACT:

The right-of-way – the section of land where a transmission line is located – needs to remain clear even if the transmission line is underground. Structures on the right-of-way can damage underground equipment. Plus, a clear right-of-way allows crews to access the underground equipment for maintenance and repairs.



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# UNDERGROUND TRANSMISSION LINES



# CONSTRUCTION OF UNDERGROUND TRANSMISSION LINES

Like road construction, burying transmission lines can cause disruption. They are often buried in or near roadways. Underground transmission line construction disturbs the land throughout the entire length of the line, whereas overhead line construction primarily impacts the pole location and access to the pole. Burying transmission lines generally includes the following steps:

**1 Preparing for construction:** Existing utilities are located so crews do not interfere with underground gas, water and sewer lines. The line route must accommodate the vehicles, equipment and materials needed throughout the construction process.

**2 Trenching:** Crews remove the topsoil in unpaved areas or use a saw to cut the concrete/asphalt in paved areas. Then, the trenching begins like an assembly line: A crew digs a trench, which can vary in size depending on the type of cable. Another crew follows behind, installing conduits made of a strong but lightweight plastic. These conduits serve as a sleeve through which electrical cable is pulled. The conduits are encased in concrete, the trench is backfilled, and the surface is ready for restoration.

**Trenchless crossings:** During construction, crews occasionally use a trenchless technique. This happens primarily around railroads, major highways and environmentally sensitive areas like streams where traditional trenching is not feasible. Trenchless methods typically involve drilling a hole underground horizontally or diagonally to get utilities from one side of an area to the other side without destroying the ground or obstacles in between.



**3 Vault installation and cable pulling:** Crews may install vaults – large concrete boxes with manhole covers – at regular intervals along the route. Afterward, cable is pulled through the conduit system and spliced together.



**4 Restoring the construction site:** After construction, crews restore roadways and surfaces to their original condition.

## DID YOU KNOW?

Even if transmission lines are buried underground, a transition structure called a riser is often installed above ground. The riser can reach 90+ feet tall and connects an overhead system to an underground system.



## COST

Underground electric transmission lines can cost 5-10\* times more than building the same lines overhead, depending on whether the area is urban, suburban or rural. Factors contributing to the higher cost of underground transmission lines include:

- Trenching and excavating
- Use of specialty insulated cable
- Below-ground construction
- Maintaining and repairing underground equipment

## WHY CONSIDER THE COST?

Considering the increased cost of building transmission lines underground is important because customers ultimately pay the cost. Sometimes municipalities or private developers are willing to absorb the cost differential, but even then underground transmission lines are not always the best solution for reliability and other considerations.

## WHAT'S THE DIFFERENCE: TRANSMISSION VERSUS DISTRIBUTION?

Transmission lines are high-voltage and extra-high voltage lines that carry electricity from power plants to substations where it is reduced in voltage and sent to customers on distribution lines. Underground distribution lines are more common because the lower voltage makes them simpler and less costly to bury and operate.

\*Source: Edison Electric Institute, "Out of Sight, Out of Mind" study, 2012.