

## UNDERGROUND TRANSMISSION LINES

ATC's practice of placing transmission lines on overhead structures is rooted in our responsibility to consumers to build projects as cost efficiently as possible.

While many lower voltage, local electric distribution lines are placed underground, particularly in newer neighborhoods, almost all high-voltage electric transmission lines are proposed as overhead for three general reasons: cost, repair time and environmental considerations.

### COST CONSIDERATIONS

Installation costs for underground transmission lines can range from 5-10 times the cost of an equivalent 345-kV overhead line. As a regulated utility, ATC is required to explore low-cost options when proposing new transmission lines since costs associated with new and existing transmission lines are passed on to retail electric customers in their monthly electric bill. Factors influencing the cost generally are site/project specific, and may include but are not limited to the following:

- **Routing** - Right-of-way, easement and permitting costs and whether the line will be placed in the road right-of-way
- **Terrain and obstacles** - Other underground utilities, streams and railroad crossings, embankments, bridges, major roads, traffic and soil conditions
- **Permitting** - Traffic and lane restrictions, noise, time of day and other construction restrictions
- **Design** - Mitigating soil thermal characteristics

### OUTAGE AND OPERATIONAL ISSUES

Failures in underground transmission lines are infrequent. However, when they occur, they are extremely costly and time-intensive to repair. Line outages can last up to a month or more as a result of the difficulty in determining the exact location in the line that needs repair. In contrast, required repairs to overhead lines can usually be completed within 24 hours.

All electric lines produce heat and therefore have a limit on the amount of power that they can carry. Underground lines cannot dissipate heat as well as overhead lines. Factors such as the type of surrounding soil, adjacent underground utilities and the depth of installation all affect the wire's ability to dissipate heat.

New underground lines can have higher thermal ratings than outdated overhead lines they are replacing; however, ATC has far less flexibility to make improvements as needed on underground lines. When lines are above ground, ATC can generally replace wires or make other improvements to carrying capacity without significant disruption. This means that ATC can respond to unforeseen circumstances, such as a change in the electric demand forecast or a change in power flow on the network, much more easily on overhead lines.

Transmission lines are rarely constructed underground, largely due to the additional time involved for repairs and higher installation and repair costs. The Public Service Commission of Wisconsin is responsible for determining when it is appropriate to put transmission lines underground. In such a case, specific construction measures are necessary for safe and reliable operation of the line. Because of these issues, underground lines tend to make sense only where there is no viable overhead corridor, such as in densely populated urban areas or in the vicinity of airports. Approximately 1 percent of ATC's 9,400-mile transmission network is located underground, all of which are 138-kV or lower voltage.

## **ENVIRONMENTAL CONSIDERATIONS**

While lower-voltage distribution lines that connect to homes and businesses can be buried directly in the ground with less invasive construction, underground transmission lines require substantial infrastructure and consideration. ATC acknowledges that there are different environmental impacts of underground and overhead lines based on the environmental setting and construction techniques and works to propose projects that minimize environmental impacts.