WHEN IT COMES TO RELIABILITY, IS UNDERGROUND ALWAYS THE ANSWER?

BACKGROUND

Following a large storm that results in widespread and lengthy power outages, one can almost bet money that at least one major media outlet will report a story or offer an editorial suggesting that the local utility (or utilities) should move their lines underground. That way, the media suggests, future outages will be prevented, or at least significantly reduced, because there will be no more overhead lines to lose power as a result of trees or limbs falling on them, or the poles breaking. And, the stories usually add for good measure, underground lines are safer, in that the potential for children or others to come in contact with live wires above ground is eliminated.

THE UPSIDE OF UNDERGROUND

There are, indeed, a lot of advantages to underground lines. Reliability is an important one. For example, a five-year study of underground and overhead reliability for North Carolina's IOUs (Duke Energy, Progress Energy and Dominion) found that the frequency of outages on underground systems was 50 percent less than for overhead systems.

And, as just noted, underground lines also provide better public safety, since there are no exposed downed lines or poles falling on homes or vehicles. An underground system is also more aesthetically pleasing.

THE DOWNSIDE OF UNDERGROUND

However, underground is not without its downsides. One of the most significant downsides is the cost associated with building such a system, especially compared to the cost of building an overhead system. Various studies have found that the cost to build new underground distribution lines is five to 15 times more expensive than new overhead construction, depending on where they are built.

A 2009 Edison Electric Institute (EEI) study found that the cost to bury existing overhead distribution lines ranged from $80,000 a mile in rural areas to $2.1 million a mile in urban areas.

Underground transmission lines are also more expensive. A 2011 paper published by the Public Service Commission of Wisconsin reported that a typical new 69 kV overhead single-circuit transmission line cost approximately $285,000 per mile, while a new 69 kV underground line cost approximately $1.5 million. Are customers willing to subsidize these kinds of costs, especially for distribution lines? The 2013 edition of an annual study published by the EEI, titled "Out of Sight, Out of Mind: An Updated Study on the Undergrounding of Overhead Power Lines," found that 60 percent of customers polled were willing to pay 1 to 10 percent more on their bills for undergrounding, 11 percent were willing to pay up to 20 percent more, and fewer than 10 percent were willing to pay up to 100 percent more.

Besides cost, there is another potential downside to underground, and this is something that surprises a lot of the members of the public. While overhead lines are susceptible to damage from ice, high winds (such as those from tornados and hurricanes), and other above-ground disasters (natural and man-made), underground facilities are very vulnerable to water damage (especially from flooding), and even lightning strikes. The aftermath of Hurricane Sandy, for example, made it very clear that underground lines were very vulnerable to flooding and subsequent water damage.

In addition, underground lines become less reliable as they get older. One reason is due to insulation deterioration. One study, reported by SCE&G, a South Carolina utility, found that customers served by 40-year-old overhead lines had better reliability than those served by 20-year-old underground lines.

Also, the North Carolina study referenced earlier found that, while outage frequency was 50 percent less for underground systems than overhead systems, the average duration of underground system outages was 58 percent longer than for overhead system outages. One reason that underground outages take longer to repair is that it usually takes longer to locate the actual outage on an underground system in the first place, whereas above ground outages are usually easy to locate. Then, once the underground outage is located, there is a significant amount of time required for trenching, cable splicing, and re-embedment. In sum, overhead lines can be repaired much faster than underground lines.

PERSPECTIVE

One trend that is also reducing any "wholesale rush" to undergrounding relates to the increasing reliability of overhead lines. As a result of FERC and NERC directives, more and more utilities are focusing efforts on "hardening" their overhead lines, such as reinforcing poles, becoming more aggressive with vegetation management, and utilizing the "smart grid" to more quickly identify the locations of overhead outages. Indeed, these initiatives are costly, but not as costly as undergrounding everything that is currently overhead.

Certainly, in recent years, a lot, if not most, of the new lines that are being run are going underground. While it is more expensive to bury the lines than it is to run them overhead, it is less expensive to underground them in new grid extensions than it is to dismantle existing overhead lines and bury them. One reason relates to the ground itself. In most cases, grid extensions occur in areas that do not yet have a lot of ground-level and

underground infrastructure already in place, such as road and sidewalks, gas and water/sewer lines, and other structures that make trenching time-consuming, dangerous and expensive.

So, what does make sense when it comes deciding whether lines should be overhead or underground?

1 - In most cases, it makes sense to underground new lines, such as in new subdivisions, unless there are specific reasons not to do so. One reason not to do so may be if the lines need to traverse certain terrains, such as swampy, marshy, or otherwise extremely wet lands, where undergrounding may be virtually impossible in the first place, or at least where the reliability of underground lines is likely to deteriorate rather quickly because of groundwater.

2 - While it may not be worth the time, effort and costs associated with undergrounding all of a utility's overhead lines, the North Carolina study suggests that utilities at least take the time to identify their overhead lines that repeatedly or frequently experience reliability problems, and then determine whether it makes sense to move these specific lines underground. That is, rather than underground the whole system, consider undergrounding specific portions of it that are likely to provide tangible reliability improvements in the future.f