Strategic and Data-Driven Grid Resiliency Programs

The T&D World webinar sponsored by Dow on Nov. 15 provided program results from three utilities

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Why don't utilities just underground all their distribution facilities and avoid the adverse weather that wreaks havoc on their overhead systems? That question is asked time and time again, right after any area gets hit by a major storm. The answer, which never immediately satisfies, is "It depends." It depends on cost, reliability history, location, soil conditions, vegetation, right-of-way, criticality of load, etc. You get the picture; there is no single driving factor and no simple solution. It requires a strategic program specific to the area, and unique to the utility system and the customers it serves.

The *T&D World* webinar sponsored by Dow on Nov. 15 provided program results from three utilities that targeted resiliency improvement on their systems that could be cost/benefit justified. The data-driven focus was shared by utility experts Ross Barrette (WEC Energy Group), Kenneth McCraw (Duke Energy) and Alan Bradshaw (Dominion Energy).

Wind, Trees and the SMRP

Wisconsin Public Service (WPS) was experiencing excessive interruption durations for its customers in heavy-density treed areas. When WPS reviewed the situation and its system average interruption duration index (SAIDI) performance relative to other regional utilities, it was confirmed that WPS didn't compare favorably and had room for improvement. As a result, WPS developed its System Modernization and Reliability Project (SMRP).

The major contributing factor to WPS' extended outages was trees falling during high winds, so undergrounding was the most beneficial reliability measure that could be taken. During Phase One (2014-2018) of the SMRP, WPS achieved a 25% reliability improvement. WPS is currently in Phase Two (2018-2021) of the program with a 17% reliability improvement expected in those areas.

The undergrounding installations thus far have yielded substantial SAIDI improvements on the portions of overhead system that have been replaced with underground cable. Overall, for the installations from 2014-2017, WPS has seen a 96% SAIDI improvement.

Undergrounding Remote and Hard-to-Access Areas

Similar to WPS, Duke Energy was suffering from an excessive amount of interruption events on its overhead system in high-tree density areas. Subsequently, Duke Energy developed its Targeted Underground (TUG) program to improve reliability and reduce risk to these outage-prone line segments.

Duke Energy analyzed its worst performing overhead circuits and discovered that particular segments incurred five to 10 times more events per mile than its best performing segments. Upon closer examination, it was determined that undergrounding radial taps would produce the most beneficial improvement, so these areas received the highest priority.

A specific tree-related challenge that Duke Energy encountered was the risk of falling trees outside of the right-of-way. Its outage history showed that the majority of outage events were, indeed, due to trees outside of the right-of-way. The inability to address these trees provided additional motive to prioritize the undergrounding in these areas.

The "communication approach" is an emphasis of Duke Energy's TUG program that precedes any and all targeted work. A project team ensures all areas of "public engagement" is touched. This includes distributing handout materials and making

videos available, so customers know what to expect before the work is started.

Lastly for the TUG program, the results to date have shown a potential 37% decrease in avoided interruption minutes during recent hurricane activity in areas of the traditional Duke Energy service territory.

Tap Lines Yield Significant Restoration Gains

Dominion Energy has been studying the effectiveness of its undergrounding efforts in earnest for over a decade. One of the outcomes of this analysis is that in addition to traditional SAIDI-based reliability programs, the utility could also improve overall reliability by creating a focus on Total Length of Restoration (TLR). This shift better weighs cost-effectiveness and resiliency improvement. This approach also better considers certain areas where numerous, extended overhead outages have occurred, and how strategic undergrounding would help.

An outcome of Dominion Energy's undergrounding data analysis indicated the need to focus on distribution tap lines to improve its TLR. For Dominion Energy, tap lines made up 50% of its total overhead distribution line mileage. Looking further, it was determined that 60% of tap line outages occurred on 20% of the tap line mileage. After this was understood, the target was to concentrate on undergrounding the 20% when possible.

Dominion Energy is currently about 25% complete with its Strategic Underground Program. The results so far indicate a 99% improvement in both SAIDI and SAIFI (frequency) indices for those areas that have been converted. Ultimately, through modeling and test case projections, it is expected that when Dominion Energy completes its program objective of converting 4000 tap line miles, it will reduce the TLR by 40-50% - that's an improvement for all customers, not just the ones whose lines are converted to underground. This accomplishment will be achieved despite spending less than 3% of the cost of "undergrounding everything."

In conclusion, strategic distribution planning and data-driven results are the keys to implementing a cost-effective undergrounding program that will yield prudent

reliability and resiliency improvement. However, quantifying and justifying these programs in many areas still remains a difficult task. If a similar program is not already underway at your utility, efforts should be made to track targeted outage performances and related costs. Cost recovery can then be duly considered by public utility commissions or other governing authorities.

Meeting customer expectations: Strategic and data-driven grid resiliency programs is now available on-demand. This was the second webinar in a three-part series sponsored by Dow addressing challenges facing the industry. The next webinar will be *Building the plan: Strategic and data-driven grid resiliency programs* on Dec. 05, 2 p.m ET.