



SUBSTATIONS OF THE FUTURE

Until about 20 years ago, substations weren't expected to do much more than be what they were - substations, whether they were generating station switchyard substations, system stations, customer substations, or distribution substations.

Certainly, new technologies were always being developed to make substations more efficient, effective, dependable, safe and reliable. However, the main role of substations, stepping power up or down, remained the same.

These days, though, substations are expected to be - and do - more, a lot more.

First, with the advent of distributed generation (DG), substations are now expected to be able to handle the flow of power in both directions - from the utility generating station to the customer, and back to the grid from customers that have DG technologies.

Second, substations must be significantly safer than they were in the past, especially for utility employees, again, because of DG. With power flowing in both directions, substations need technologies in place that provide workers with comprehensive and continuous information about the flow of power in both directions, so that workers can remain safe when working in and around the substations.

Third, with the advent of the smart grid, substations must do more than just ensure the flow of power. They must also gather and facilitate the flow of information to, from, and within the grid.

Fourth, substations have always been expected to have features to ensure the safety of those outside of the substation property. In the past, chain link fences with barbed wire strung along the top tended to be sufficient. However, with the growing demand for scrap metal in the past decade or so, substations have become appealing targets for thieves, so even more physical security measures are often necessary.

Fifth, there is another security issue: cyber security. Substations must be designed to resist this type of crime, especially with the expansion of the smart grid.

Finally, although certainly not as important as the first five new requirements, more and more utilities are considering the "aesthetic" and "environmental" aspects of substations, attempting to make them more visually appealing when they are in public view, or even hiding them completely from public view.

For all of these reasons, modern substation design must take a number of concerns into account, including reliability, physical security, cyber security, interoperability, reconfigurability, controllability, maintainability, flexibility, and environmental impact, while at the same time attempting to meet all of these requirements in the most cost-efficient manner possible.

Certainly, no electric utility has the financial resources to design and install completely new substations throughout its system. However, it is important to take these new substation requirements into account as part of short-term and long-term planning initiatives.

According to Mladen Kezunovic, Ph.D. the Eugene E. Webb professor in the Smart Grid Center at Texas A&M University, utilities have four options when it comes to planning substation designs in the future.

The first option is to introduce upgrades while maintaining the current substation design. This involves identifying the most pressing and immediate issues for upgrades and implementing these as cost-effectively as possible as a way to extend the life of the existing substations.

The second option is to retrofit the existing substation design. This involves looking a few years down the road and considering major upgrades and value-added applications, based on a comprehensive survey.

The third option is to implement a new substation design. This involves creating a replacement strategy using a time window encompassing an even longer timeframe into the future than the retrofit strategy, based on certain assumptions related to anticipated regulatory and technological developments.

The fourth is to implement a greenfield substation design. This involves looking even further out than the previous option, and, as a result is the most risky option, given the need to consider what regulatory requirements, technological advancements, and operating practices may be in place at that time.

Substation upgrades are not a “business as usual” approach with the multiple considerations that need to be addressed. Our experienced team can work through the questions and develop solutions for your specific strategy.



ABOUT THE AUTHOR

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