USING AST AND FLISR TO IMPROVE SYSTEM RELIABILITY

Contents:

Fortunately, as challenges mount for reliability and efficiency for electric utilities, technologies, including new ones and existing ones that continue to improve, help keep pace with these challenges. Two of these technologies are AST (Automatic Source Transfer) and FLISR (Fault Location, Isolation, and Service Restoration) to which utilities should pay attention in particular.

Introduction

The reliability of an electric power utility is most commonly measured by SAIDI (System Average Interruption Duration Index), which is the average outage duration for each customer served and is calculated from the sum of all customer interruption durations per the total number of customers served. Studies have shown that a 20-37% reduction in outage duration can lead to a 7-15% improvement to SAIDI. The most effective way to improve SAIDI is to reduce the consumer outage duration and system automation has proven to be an efficient tool for improving system reliability.

With the continued advancement of Smart Grid technologies, one of the notable uses is system automation. System automation can be used for any number of facets including, but not limited to, increasing efficiency, enhancing safety, and improving reliability, the latter of which is a key focus for electric power utilities.

AST and FLISR automation systems can both be effectively used to restore power to customers automatically without having to send field personnel out first to reduce the effects of an outage. They have become very popular not only for improving reliability, but also to increase efficiency and enhance safety.

AST

Automatic Source Transfer (AST), is most common for a smaller area or a single load but is also used for backfeeding using a circuit tie with a neighboring source. This is a direct means for serving critical loads that cannot tolerate a sustained outage in the event of a fault on the preferred source. The automatic transfer is accomplished with the use of switches and/or reclosers which communicate with each other for high-speed transfer to minimize outage time and improve reliability without the delay of having to send field personnel to the site to restore power.

How common is AST among Finley clients? Larger co-ops usually implement this more. There are likely some Finley clients who use AST, and there are some that don't but could benefit from it and could maybe use this whitepaper to help learn the benefit and maybe look into it more.

Is AST underutilized? In other words, should it be used more, and, if so, under what circumstances? We at Finley believe that it is underused, especially if the utility already has some electronic reclosers installed and some form of communication, even if it is very basic.

For two AST devices, the communication between them can be very basic and would not require a lot of intricate communication infrastructure. A good application for a two device AST would be
for a critical load that cannot be interrupted for a sustained fault for any length of time. The AST devices can sense the outage to the single customer and switch the customer to another source so they do not have a lengthy outage.

Another application would be for a large revenue customer of the utility. They don't want to have them out of power and lose that revenue source, so the AST can switch to another source and keep them up and running.

Another consideration where AST would be useful would be if the utility has a portion of its system which is hard to access and would take a long time for field personnel to reach to restore an outage. If they have AST and can automatically re-energize a portion of line with field personnel en route to fix any problems, that will greatly improve their reliability and SAIDI and reduce outage time.

FLISR

The U.S. Department of Energy offers a formal definition for FLISR: "FLISR technologies and systems involve automated feeder switches and reclosers, line monitors, communication networks, distribution management systems (DMS), outage management systems (OMS), supervisory control and data acquisition (SCADA) systems, grid analytics, models, and data processing tools. These technologies work in tandem to automate power restoration, reducing both the impact and length of power interruptions."

"FLISR applications can reduce the number of customers impacted by a fault by automatically isolating the trouble area and restoring service to remaining customers by transferring them to adjacent circuits. In addition, the fault isolation feature of the technology can help crews locate the trouble spots more quickly, resulting in shorter outage durations for the customers impacted by the faulted section. The reduced number of customers interrupted (CI) and the associated customer minutes of interruptions (CMI) are the primary measured benefits of the technology."

FLISR is used to quickly identify the location of a fault and then isolate the faulted area as tightly as possible such that the impact of the power outage associated with the fault, both in terms of the duration and the numbers of customers affected, is minimized. This is also accomplished with the use of switches and/or reclosers with communication capabilities.

FLISR can be used when multiple devices are installed and set to coordinate with each other and communicate with each other to create “zones,” if you will. If there is a fault in one particular zone, the multiple devices will communicate and operate to isolate that zone and backfeeding the other zone from another portion of line or another source to reduce the number of consumers out in the event of a fault. As a contrast to AST, FLISR is used to be able to strategically restore power to many consumers as opposed to just one critical consumer or one large consumer.

How common is FLISR among Finley clients? FLISR is still pretty new and it is Finley’s experience that most utilities don’t utilize it because of its complexity and cost.

Should it be used more? If so, under what circumstances? It seems to be underused significantly, again, because of its complexity and cost. As with AST, a good circumstance for using FLISR is on a portion of the system that is hard to access and would take a long time for field personnel to reach to restore an outage. Another consideration is on a largely populated feeder where a fault could interrupt many customers which would affect the utilities SAIDI reliability number. Not all zones may be able to be restored by back feeding or switching to another source, but if any number of customers can be restored, it reduces the severity of an outage.

Comparisons

While an AST scheme is fairly simple to setup and implement, FLISR is significantly more complicated. A typical AST scheme involves two devices, one normally open and one normally closed. Each device has one set of parameters to detect a fault and is coordinated and communicates with the other device to detect the fault, open or close as needed, and restore power automatically. A FLISR scheme usually involves multiple devices with multiple sets of parameters to detect a fault, coordinate and communicate with multiple devices to isolate the fault zone and restore power to as many customers as possible. FLISR has multiple parameters to evaluate including but not limited to direction of feed, load current, location of fault, a zone of isolated fault.

The cost for an AST is fairly inexpensive, as it usually only involves the two devices, setup of parameters and communication between the two. On the other hand, FLISR is considerably more costly for the multiple devices, additional hardware to effectively set up the communications and monitor the coordination and communication between all devices. However, when implementing, the cost savings from loss of usage and the improvement to the reliability of the system is extremely beneficial to the utility coordination setting and present backfeed scenarios.

Assistance From Finley

The main challenge in implementing AST is not being able to determine the coordination or communications settings between two devices. Finley can run the analysis and determine locations that could benefit from an AST. Finley can also determine the coordination settings and help input the settings into the devices.

The main challenge in implementing FLISR tends to be the costs as well as the personnel to implement and maintain the system. Here, Finley can run the analysis and multiple scenarios for backfeed options and determining zones and number of devices to install to be able to set up the scheme. As with AST, Finley can determine the locations and the coordination setting and present backfeed scenarios.

ABOUT THE AUTHOR

Christopher Smart, P.E.
c.smart@finleyusa.com

Chris Smart is a licensed professional engineer with 20+ years of experience in electric utility consulting, specializing in distribution system planning and analysis.

He has supported over 20 cooperatives, municipalities, and investor-owned utilities with distribution and substation planning. Chris is a member of IEEE, MSPE, NSPE, and TSPE.