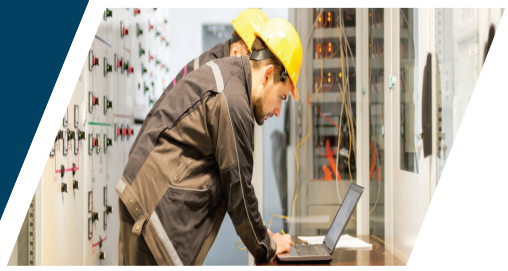


OVERLOOKING RELAY COORDINATION ACROSS ORGANIZATIONS, A CAUSE FOR ALARM

Protection Engineering - Part Two of Four

In part one of our series we discussed the risk of not updating your relaying system. The effectiveness of any type of ground overcurrent relaying is dependent on having a properly functioning substation ground grid, which will assist in providing a current path from the fault back to the substation. If a high-resistive ground fault occurs on YOUR system, will YOUR breakers or reclosers trip?

In part two, we discuss relay coordination and the communication that must take place to avoid costly mishaps. If sufficient communication does not take place regarding relay coordination, catastrophes can occur. These situations can occur with municipal utilities, rural electric co-ops, investor-owned utilities of all sizes, and perhaps even large customers. The scenario could involve two utilities not coordinating relay settings between each other, a single utility not coordinating relay settings between its internal departments, or between a utility and its large load customer.

Let's look at one of these scenarios in detail - municipal utilities and rural electric co-ops that purchase their power from G&Ts. In such a scenario, the municipal utility or rural electric co-op is responsible for their own 12 kV or 13 kV distribution. However, they purchase their transmission from a G&T, which is predominately 69 kV or 161 kV.

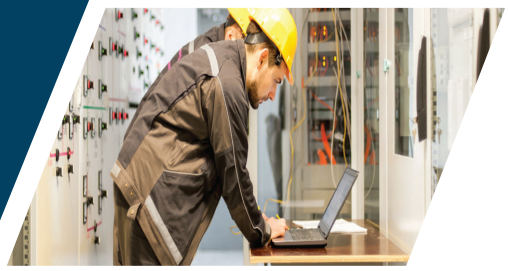
The transmission provider will likely have its own staff of relay protection engineers, but most municipal utilities and co-ops do not, so they usually contract with an outside firm to specify relay settings for the distribution side of their substations.

One Midwest municipal utility, which serves the needs of about 10,000 citizens and businesses, hired a consulting firm to specify relay settings for its portion of the substation, which involved all of the 13 kV feeder recloser relays. The transmission provider also had relays in the substation, but its own engineers had already set those.

Subsequently, there was a fault (caused by a squirrel) on one of the municipal utility's feeders about half a mile from the substation. Instead of that utility's feeder recloser taking care of the fault, one of the transmission provider's relays at the substation kicked into operation, which de-energized the entire substation. In sum, one, solitary squirrel on one feeder circuit, half a mile away from the substation, took the entire substation out.

As a result, instead of losing just one feeder circuit, the utility lost four, which served about half of the city. This particular substation serves the downtown area of this community, so not only did it take out power to residences, but it also took out power to most of the community's retail and other commercial businesses, as well as a number of governmental facilities. In sum, not only were citizens out of power, but the outage impacted the economy of the whole city.

The utility called Finley Engineering to investigate the root cause of the problem. Finley discovered that the consulting firm that the utility contracted to specify its 13 kV relay settings had never contacted the



transmission provider to coordinate their work, and in addition, the transmission provider did not communicate with the municipal utility or its consulting firm. As such, there was no relay coordination at all between the two utilities. Finley Engineering was able to coordinate the relay settings for the entire substation to enable a proper response to future faults.

Other Potential Scenarios

As noted earlier, this potential problem isn't limited strictly to municipal utilities and rural electric co-ops that purchase their power from G&Ts. Any utility can run up against this, even if it owns both the transmission and distribution system. This can be especially true if transmission is part of one group and distribution is part of a separate group. These two groups must coordinate their work when it comes to substation relays.

The mergers and acquisitions that are taking place today in the utility industry can create situations in which miscommunication, or even total lack of communication, can occur related to relay coordination. This is especially a concern as new owners take control of, and connect with, the existing utility infrastructure.

Potential problems can also occur if a utility doesn't coordinate its substation relay work with its neighboring transmission providers. Since we have what is essentially a national grid, and everyone is tied to someone else, wherever there are transmission ties between two organizations, relay coordination must be handled properly.

Granted, at the transmission level, there will likely be two in-place transmission relay protection groups talking to each other, but this isn't always guaranteed, and miscommunication, or lack of communication, can still take place.

Large load customers generally work very closely with their providing utility to coordinate protection, so the instances of relay mis-coordination is usually low. The utility's initial emphasis is to ensure that infrastructure is in place to serve the additional load, but communication must take place to ensure that all protective devices coordinate properly.

Strategies

As such, regardless of whether you are a municipal utility, a rural electric co-op, or an investor-owned utility, the potential for lack of relay coordination can occur as a result of miscommunication, or lack of communication. Unfortunately, you will likely know nothing about this mis-coordination until an undesirable protective relaying operation happens, such as took place in the example above.

However, such calamities can be prevented by having professionals from a firm such as Finley Engineering review your whole system, including substation relays both on the transmission side and the distribution side. In other words, while attention will be paid to substation relays in specific, Finley Engineering will look at your system holistically. The company's system protection engineers will review the "big picture," including the whole scheme of protection engineering requirements.

About the Author

Mark Thatcher, a Senior Protection Engineer for Finley's Energy Division, has over 30 years of engineering experience in the energy industry. His experience and responsibilities include performing fault studies and calculating protective relay settings for new or existing transmission, substation, and distribution facilities, and in addition he is responsible for analyzing fault occurrences and determining appropriate setting modifications to enable proper operation. Mark is also responsible for specifying and implementing relaying schemes, involving microprocessor based relays as well as electromechanical relays as needed or required. He is responsible for project coordination for individual projects and supervises the testing of new electrical distribution facilities

If you have any questions about these solutions or want to discuss this topic further, please contact Mark Thatcher, 913-601-3518 .

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