

Mid-South Synergy Uses DFA Technology to Avoid Substation Switch Failure

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DFA technology provided Mid-South Synergy Electric Cooperative's (MSEC's) only notice of early stage substation switch arcing. MSEC averted potentially catastrophic failure by initiating emergency repairs within two hours of learning of the issue from DFA.

MSEC is one of seven utility companies participating in the Texas Power Line-Caused Wildfire Mitigation project, a field demonstration supported by the Texas legislature. Over the past three years, MSEC has used DFA to detect a variety of issues, including: conductor slap; a phase conductor charring a wooden crossarm; capacitor problems; failing switches; and other issues. MSEC initially installed DFA on ten circuits, primarily long, rural circuits, and currently is adding DFA to ten more. Each circuit has a single, substation-installed DFA device, which detects faults, failures, and other events along the circuit's length and reports them to a central master station server computer for access by personnel.

DFA detected the failing switch based on specialized software that monitors line currents and voltages continuously and automatically recognizes signal patterns indicative of switch failure. MSEC received the DFA report late on a Saturday afternoon and responded immediately.

MSEC did not know immediately which of the circuit's multiple switches was the culprit. MSEC had no active member complaints, and none of their other systems indicated a problem. MSEC operators used their AMI (advanced metering infrastructure) system to ping meters on the affected phase, based on the thought that meters downstream of the arcing switch might report something unusual, but that was not the case. DFA estimated that the offending switch was carrying most of the circuit's load, and MSEC used that information to direct patrols near or in the substation. Upon arriving at the unmanned, rural substation, the responding lineman distinctly heard "sizzling" and knew that he had found the arcing switch. Despite the remote location of the substation, MSEC located the arcing switch within two hours of their first notice.

MSEC found the switch on a Saturday evening. Because of the serious nature of the issue, they initiated corrective action immediately. Catastrophic failure of the switch would have caused an outage for at least one circuit. Because the switch was located on the substation buswork, its catastrophic failure could have caused an outage for the entire substation. In the extreme, it could have caused a substation fire, particularly if a high-current fault on the circuit precipitated the switch's final failure.

Replacement was timely, because MSEC's service territory experienced thunderstorms each of the next two days, and those storms caused multiple faults on the circuit. Had the weak switch still been in service, the added stress of carrying fault current and other system transients likely would have caused its catastrophic failure. The substation has three circuits, all three of which needed to be switched to alternative sources of supply while the switch was replaced. Early warning enabled all load to be switched to alternative sources without outage and without the time pressure that would occur had the switch failed and caused an outage to one or more circuits.

DFA technology enables a utility to manage its power distribution system better, by providing awareness of line conditions and events not detected by conventional technologies. Each substation-installed DFA device monitors circuit currents and voltages continuously, via conventional CTs and PTs. DFA devices use embedded pattern-matching software, known as the On-Line Waveform Classification Engine, to characterize and report electrical events, including events not detected by conventional means. DFA devices report line events to a master station server, which provides access to reports from the system-wide fleet of DFA devices. DFA reports conventional faults and also events that have not yet caused faults or affected customers. Awareness of adverse events and conditions enables preemptive action, directed repairs, and condition-based maintenance. No technology can detect all problems, but DFA provides a quantum step forward in the detection and diagnosis of many failures and incipient failures.

DFA technology was developed by Texas A&M Engineering, in collaboration with the Electric Power Research Institute, Inc. and is offered commercially by Texas-based Power Solutions, LLC.



Headquartered in Navasota, Texas, Mid-South Synergy serves 23,000 members and 30,000 meters in a service territory covering parts of six counties in Central Texas. Mid-South initially installed DFA technology on ten distribution circuits and currently is installing DFA on ten more.