Pickwick Electric Cooperative Uses DFA to Avoid PQ Problems and Catastrophic Switch Failure

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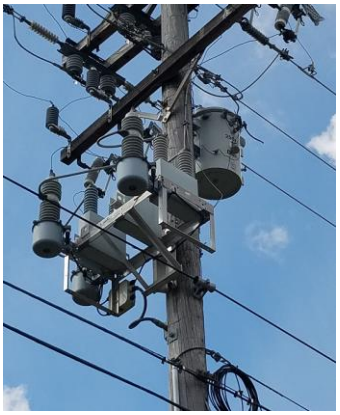
Pickwick Electric Cooperative (PEC) used Distribution Fault Anticipation (DFA) technology to perform condition-based maintenance on a capacitor bank with a failing vacuum switch, thereby avoiding power quality problems and potentially catastrophic switch failure. No conventional technology, including a remote communications system PEC uses to manage their capacitor banks, alerted PEC to the problem.

Like many utility companies, PEC applies switched and fixed capacitor banks on its distribution circuits. PEC's remote capacitor communications capabilities enable them to detect problems such as blown phase fuses. Such systems cannot, however, detect latent or incipient problems such as switch bounce or symptoms of partial loss of vacuum in a switch.

On 17 February 2017, the DFA device on one of PEC's circuits detected a three-phase capacitor bank switching off and, more importantly, detected that one of the bank's switches had experienced severe restrike during the operation. Restrike is a phenomenon that occurs when switch contacts open and interrupt the flow of current, but immediately thereafter fail to withstand the voltage across them and consequently allow unintended current to flow, typically for a very short period of time.



The subject capacitor bank is programmed to open and close daily. For several days following the severe restrike, the bank switched normally, with no indication of restrike. Then on 22 and 23 February, DFA again detected and reported severe restrike.

PEC readily identified which of the circuit's capacitor banks was experiencing the restrike, by comparing the DFA-reported kvar bank size to the nominal size of the banks known by PEC to be on the subject circuit. They further confirmed the identification of the specific bank by comparing DFA-reported switching times with times reported by the bank's controller via SCADA.

Based on the notice of severe restrike and identification of the affected bank, PEC visited the bank on the afternoon of 23 February. They found that the bank had a switch with partial loss of vacuum. They opened the bank's fuses to isolate the bank, pending full repair. This prevented multiple possible problems, including power quality events for PEC's members and potentially catastrophic failure of the switch itself. DFA provided the only notice that PEC had that any problem existed.

PEC is one of more than 150 local power companies that buy bulk power from the Tennessee Valley Authority (TVA). Both PEC and TVA were key participants in the long-term development of DFA technology. The latent switch problem described herein is one of multiple problems and latent failures that PEC has detected, diagnosed, and corrected using DFA technology. It is PEC's experience that DFA provides them with a level of awareness of their circuits that they do not get from their conventional technologies, and that better awareness enables improved operations and better service to their members.

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 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 Selmer, Tennessee, Pickwick Electric Cooperative operates 2427 miles of distribution and serves 20,555 members in a service territory covering parts of five counties in Tennessee and Mississippi. Pickwick has been a key, long-term participant in the development of DFA technology.