

# Pedernales Uses DFA Technology to Reduce Vegetation Wildfire Risk and Increase Reliability

Robert A. Peterson, P.E.  
Director, Control Center and Emergency Preparedness  
Pedernales Electric Cooperative

Carl L. Benner, P.E.  
Research Associate Professor  
Texas A&M Engineering

April 2016

Pedernales Electric Cooperative (PEC) improved reliability and reduced wildfire risk by detecting, locating, and clearing vegetation contacting a rural, overhead distribution line near Blanco, Texas. Distribution Fault Anticipation (DFA) technology enabled this by detecting early warning signs of the vegetation intrusion. Conventional technologies did not notify PEC of this condition. Rather PEC's only notification came from DFA.

PEC is one of six utility companies participating in the Texas Power Line-Caused Wildfire Mitigation project, a field demonstration effort supported by the Texas legislature. As part of that effort, PEC has instrumented ten distribution circuits, primarily long, rural circuits, with DFA technology. PEC has instrumented each of these circuits with a single, substation-installed DFA device, which detects and warns of faults, failures, and other events along the length of the circuit.

Latent power line conditions, such as vegetation intrusion and certain apparatus failures, can cause recurring fault events. Many such conditions are affected by weather conditions, such as wind and moisture, and therefore cause fault events only intermittently. These conditions are difficult to detect and locate with conventional technologies.

Like most utility companies, PEC applies automatic circuit reclosers at multiple locations on long circuits. Such a recloser attempts to clear temporary faults by tripping a section of line, waiting a few seconds, and then reclosing to restore service to customers. This momentary interruption clears most faults successfully, without causing a lengthy outage or requiring unnecessary patrols by line crews.

In the early morning hours of 06 March 2016, a fault caused a single momentary trip/close operation of a recloser on one of PEC's DFA-monitored circuits. Some 30 minutes later, the fault recurred and again caused a single trip/close operation. Eight hours later, the fault occurred a third time, once again causing a single trip/close operation. No customers experienced a sustained outage, no customers called to complain of the momentary "blinks," and no conventional technology notified PEC of a problem requiring investigation.

DFA detects and characterizes fault events. In addition, each time it detects a fault event, it calculates multiple parameters about that fault event, compares those parameters to those from recent fault events on the same circuit, and, if it detects multiple similar fault events, generates a special "recurrent fault" report. In the subject case, DFA detected that the three momentary trip/close operations likely resulted from the same fault condition, alerted PEC to this fact, and provided information PEC could use to locate the problem.

The circuit in question is a long rural circuit with 153 miles of primary line conductor. Upon receiving the DFA report indicating a recurrent fault, PEC utilized DFA-generated fault parameters, PEC's electronic circuit model, and "blink counts" from PEC's AMI (automated metering infrastructure) system to direct a search to a small portion of that long circuit. A PEC crew patrolled the indicated area and efficiently found and removed the cause of the recurrent fault: a tree branch on the overhead line. By responding in a timely way, the line conductors avoided damage and possible burn-down. In addition this preemptive action avoided possible future faults and interruptions to customers and removed the source of a possible future fire ignition.

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 continuously monitors circuit currents and voltages, with high-fidelity, via conventional CTs and PTs. DFA devices use embedded, proprietary signal processing to characterize 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 fleet of DFA devices on circuits across the power system. 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.

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



*Serving more than 270,000 customers in a service territory covering 8,100 square miles in the Texas Hill Country, Pedernales Electric Cooperative is the largest electric cooperative in the United States. Pedernales has installed DFA technology on ten distribution circuits as part of its participation in the Texas Power Line-Caused Wildfire Mitigation project.*