Outages and Blinks

I would like to remind everyone the reason why the Las Animas Municipal Light & Power switched from the Black Hills Electric System to the Tri-State Electric System on May 18th was Black Hills is rebuilding their 69KV Sub-Transmission line from Fowler to LaJunta. They are also building a new 115KV Transmission line next to it and adding a new 115/69 Substation Transformer at the LaJunta Substation that feeds power to us. That should help with low voltage problems in summer months that we have experienced in past years. We are scheduled to switch back to the Black Hills Electric System mid-September.

Now, I would like to address the recent outages and blinks that we have been experiencing. Twice we lost power from the Tri-State System due to lightning strikes on the 69KV line between Fort Lyon and Lamar. Many of you have called and asked about daily outages. First and foremost, we have not had an outage since July 30th when the underground feeding Circuit #6 in the Las Animas Substation Shorted out. We have been having momentary faults.

Now I would like to explain some of our high-tech equipment that we have in our Substations that are used by every Electric Power Utility in the United States. First we have Reclosers. In electric power distribution, Automatic Circuit Reclosers (ACRs) are a class of switchgear which is designed for use on overhead electricity distribution networks to detect and interrupt momentary faults. These reclosers are essentially high voltage rated circuit breakers with integrated current and voltage sensors and a protection relay, optimized for use as an overhead network distribution protection asset. In short they are to protect our Multi-million dollar Power Transformer in the Substation from damage in the event of a short circuit on the network. For overhead distribution networks, the majority of faults are transient, such as lightning strikes or foreign objects (Tree Limbs, Birds, Cats, Squirrels and Snakes) coming into contact with the exposed distribution lines. 80% of outages can be resolved by a simple close operation. These reclosers are designed to handle a short close-open duty cycle. Electrical Engineers configured years ago the number of attempted close operations that our reclosers will do prior to transitioning to a lockout stage or also known as an outage. Our reclosers were configured to count 3 times and then on the 4th count it goes into lockout. Both, the Las Animas and Fort Lyon Substations have 5 reclosers, which actually devides the network into smaller sections. Prior to the invention of reclosers, each substation was protected by one Oil Circuit Breaker (OCB), which presented a major problem when dealing with transient faults. For instance, in a windstorm, a tree limb blown off a tree might land on a power line and may cause a short circuit and cause damage to the Power Transformer. However, the fault could quickly clear itself by the limb falling to the ground. The OCB in the Substation would trip and the entire network would be blacked out, several hours while line crews would search for the fault and then reset the breaker. Reclosers are programmed to automate the reset process and allow for a more granular approach to service restoration. They have also increased availability of supply.

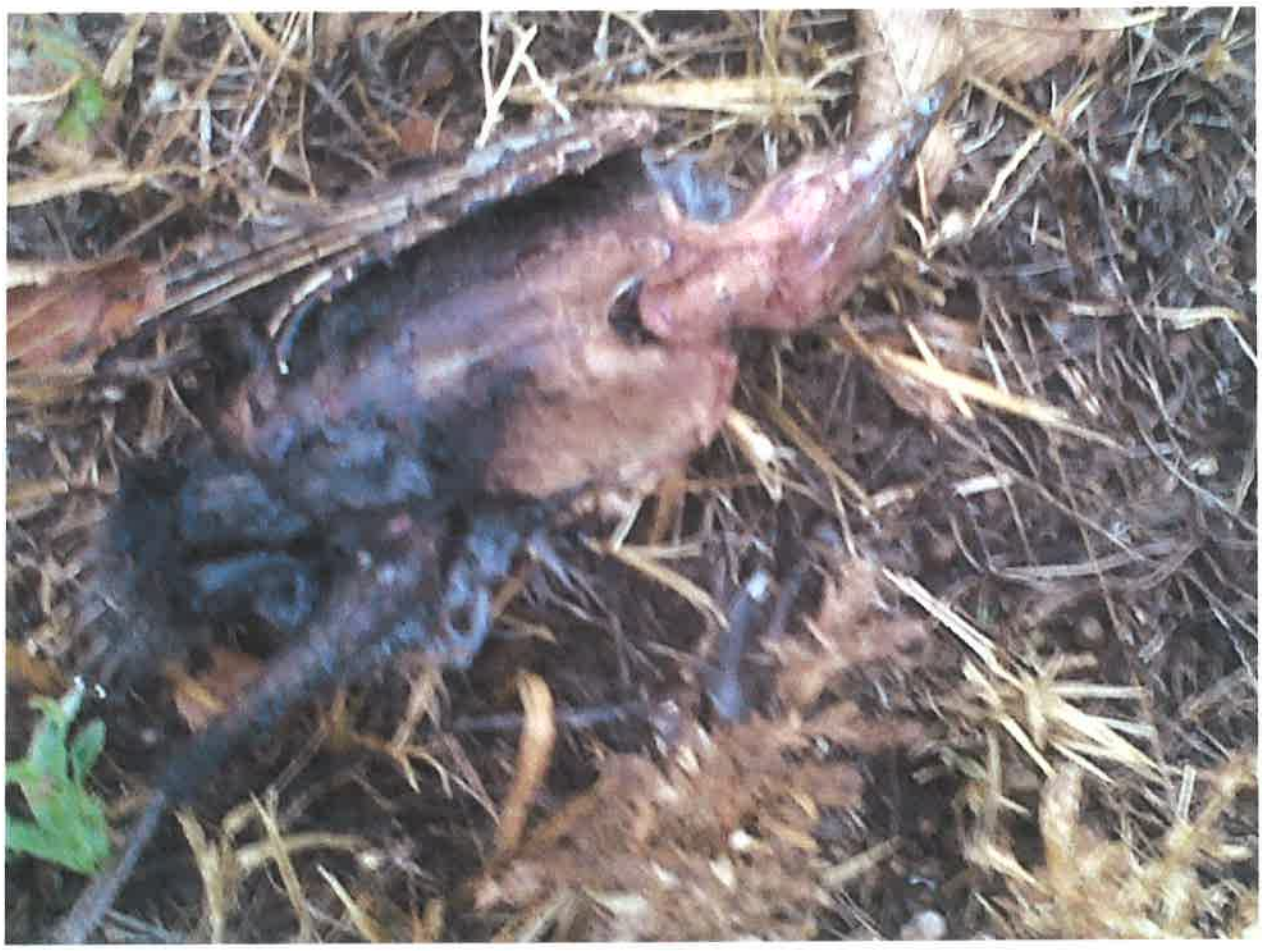
The following is Reclosing Principles: Whilst original hydraulic recloser designs had rudimentary protection capabilities, modern semiconductor controlled devices exhibit sophisticated control systems which allow for the configuration of varying responses to different classes of faults on the distribution network. The number of reclose attempts is limited to a maximum of four by recloser Standards. The basic philosophy of reclosing is to actively consider the fault cases and provide an effective response based on the fault type, this is done on a probabilistic methodology in conjunction with the detection of fault type.

The most common fault type on an overhead distribution network is lightning strike. Lightning surges cause an increase in voltage which can cause localised breakdown of insulation, allow arcing over insulators. Reclosers can detect this as an overcurrent or earth fault (depending on the asymmetry of the fault). Lightning surges pass very quickly (reduce in 50ms), so the first reclose operation of a recloser can be configured to both trip and reclose quickly. This first reclose allows for interruption of the arcing caused by lightning, but restores the power quickly.

If the recloser closes onto a fault, it is likely that the fault is a secondary class of fault, vegetation contact or equipment failure. An overcurrent fault would indicate a line to line class fault, which can be confirmed by negative phase sequence overcurrent protection, whereas an earth fault can indicate a Line to Ground or Double Line to Ground fault. Reclosers can then apply a fuse burning policy, where they remain closed for a short period to allow fuses on lateral lines to burn, isolating the fault. If the fault is not cleared, the recloser trips open again. This same policy can be used to deliver energy to fault sites to burn the fault off the line. This could be a branch crossing between multiple lines, or fauna (birds, snakes, etc.) coming into contact with the conductors.

Sensitive earth fault protection in reclosers is typically set to immediate lockout. This detection of small leakage currents (less than 1 ampere) on a medium voltage line can indicate insulator failure, broken cables or lines coming into contact with trees. There is no merit in applying reclosing to this scenario, and the industry best practice is not to reclose on sensitive earth fault. Reclosers with sensitive earth fault protection capable of detecting 500mA and below are used as a fire mitigation technique, as they provide an 80% risk reduction in fire starts,[7] however they are never to be used as reclosers in this application, only as single shot distributed circuit breakers which allow for sensitivity to verify the existence of these faults.[8]

Next, I would like to add some pictures of what started out as transient faults that did not clear themselves and did cause larger outages. The first was a bird that came into contact with the line on west 6th. The recloser went through the counting sequence and transitioned into lockout when two phase burned in two.



The next two are of a snake that made contact, did not clear itself and tripped the Black Hills Circuit Breaker in the LaJunta Substation that feeds us.

In closing, most of you have been seeing the affects of our reclosers in action dealing with the transient faults. If the fault is on the circuit you live on, you will see one or several brief, complete outages followed by either normal operation indicating the fault has cleared or a complete outage of service indicating the recloser transitioned into lockout. If you live on an adjacent circuit, you may see several dips in voltage as the heavy fault current flows into the adjacent circuit and is interrupted one or more times. This would resemble during an electrical storm. The reclosers actions do result in your electrical devices to lose time settings, losing data in volatile memory, halt, restart and could suffer damage. Owners of such equipment should always protect their electronic devices against power interuptions.