Current Comments

Energizing South Central Nebraska

SOUTH CENTRAL PUBLIC POWER DISTRICT, NELSON, NEBRASKA

OBJECTIVE: To make electricity available at the lowest cost consistent with sound economy and good management.

Max's Column

By
Max VanSkiver

WINTER STORMS

As I write this, we are 11 years and counting since our last major winter storm. The "New Year's Eve" storm of 2006 knocked power out for much of central and south central Nebraska.

The "New Year's Eve" storm of 2006 was an "icing event" and actually started on December 30, 2006, but our crews were able to restore service to most people affected on the 30th. The situation did not become overwhelming until the 31st.

All told, 6,275 electric services lost power at some time during the storm and 2,042 miles of electric line were off at one time or another during the storm. Expressed on a percentage basis, 85% of all electric services lost power at some time during the storm and 86% of all electric line was off at one time or another during the storm.

Approximately 700 poles were destroyed and miles of line were down, and yet we were able to restore service relatively quickly.

As of Sunday morning, January 7, 2007, only a few residential accounts with damage at their individual sites remained out of service. Every home had electric service before the evening of January 7th, eight days after the event knocked most of the system offline.

Getting the "lights on" that quick was not a "miracle". It was a result of hard work by all involved in the process of restoring electric service and the District's commitment to doing anything affordable to maintain and improve the resiliency of its power delivery system.

Major winter storms do not occur at a predictable frequency. We could go two weeks between major storms or twenty years or more.

Consumers should do what they can reasonably afford to prepare for these kinds of events. A standby generator (tested, ready to go, with extra fuel) is ideal, but not everyone is in a situation to have one. At a bare minimum, working flashlights where you can reach them and few jugs of drinking water are a must. If a winter outage promises to be a long one, a decision regarding where to stay may need to be made. If one does vacate, the home should be winterized. Individual choices are many and varied; I cannot begin to cover them all. There are plenty of locations on the internet that one can reference to help prepare.

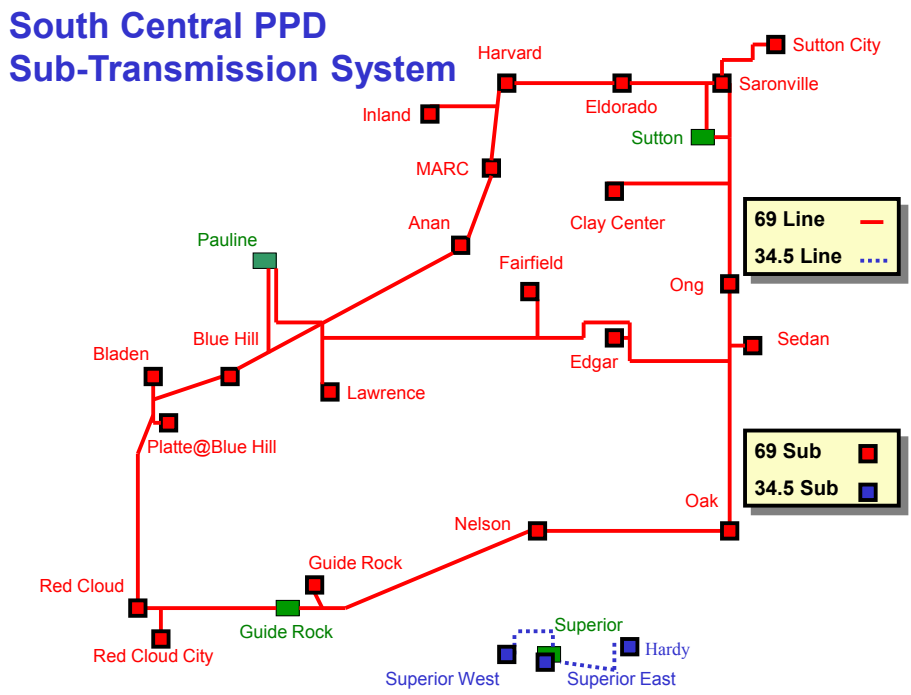
It is financially and physically impossible for the District to stock enough poles and material to deal with a 500 to 700-pole storm using stock from our warehouse. We maintain enough poles and material to allow us to work most of a week without resupply and we assess the level of damage early in the event so we can get poles, material, and crews to assist us coming our way sooner rather than later. Efficient management of crews and material is important.

HOW WE WORK MAJOR STORMS

An outage occurs when an electrical system component fails or is damaged to the point that it cannot perform its job. The duration of the outage is largely determined by what the component is, how soon we can get someone on-site to deal with it and whether there is a way to reroute power flows. This happens no less than hundreds of times during a major storm, and there can be thousands of damaged components!

Overloading of the telephone system is the first thing that happens during a major storm event. We call office staff in to handle the telephone calls and we have four incoming telephone lines. That is **NOT** adequate to handle several hundred calls at the same time. People get busy signals. I am sometimes asked why we do not use an answering service to handle the high volume of calls. During the early hours of a major event, we desperately need accurate information with regard to who is out of service. While an answering service could take your calls rapidly, it would add an extra step to the process of getting important information to the dispatcher and actually slow down the initial restoration process. In addition, when you call, we also often ask questions of you to help us acquire helpful information.

A few months back I wrote about how "the grid" works, so I will not repeat it here. A drawing of South Central Public Power District's sub-transmission assets appears below. It all starts in the four NPPD substations, shown in green. If there is no power available to us in any of those substations, we do not have any power to distribute to you. To date, there has never been a time when we could not pull power from at least two of the four NPPD substations.



The drawing implies that all of the red lines are tied together. That is true mechanically, but not electrically. Power flows ***from*** an NPPD substation into our transmission system on through our distribution system ***to*** your meter.

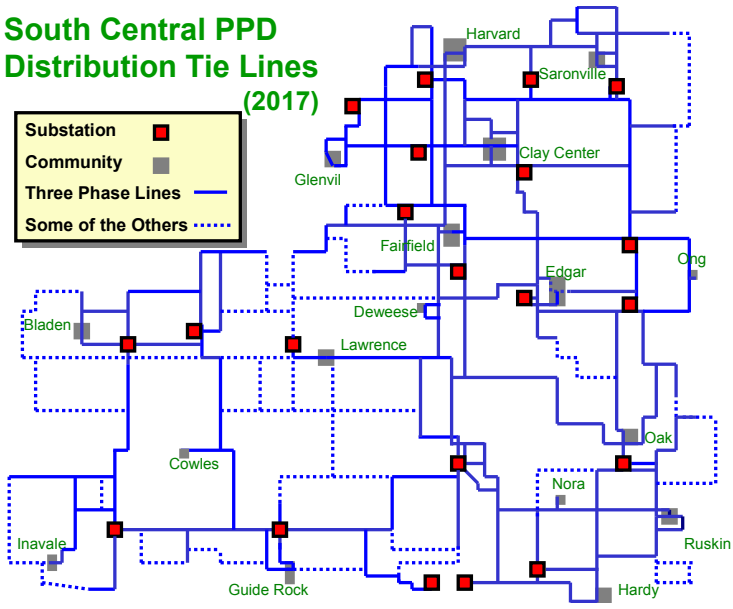
If our transmission lines were all tied together, power would try to flow across our system in parallel with the power flows across the area NPPD transmission system; at least for a short time. Power cannot be allowed to flow from an NPPD substation through our transmission system and then back into another NPPD substation. Our system simply cannot handle the electric currents involved in such power flows.

So, the lesson here is that South Central's entire electrical system is designed for power flows moving one direction, "from source to load". There is an "open point" in all transmission lines that run between NPPD substations. There are switches in or next to every substation. We can move open points by the closing and opening of those switches.

So, **our second step in service restoration after a major storm is to get as much of our sub-transmission system as we can and the substations it serves, energized.** Since most of the system is designed as tie lines between NPPD sources, we can operate switches to isolate transmission line segments with problems and move power into substations from a different NPPD source than the one normally used.

During the first day after a major storm event, we will spend much of the day rerouting power flows around damaged parts of the transmission and distribution systems. This gets power restored to as many people as possible as fast as possible.

A drawing of South Central Public Power District's distribution tie-lines is shown below.



Like the transmission system, we have established tie-lines within our distribution system. Tie-lines represent less than 10% of the total miles of distribution line in service. Showing the other 90% of the distribution lines in service would make the map unreadable at this scale.

A distribution tie-line cannot move anywhere near as much power between two points as a transmission line can. However, a distribution tie-line can allow us to restore power to undamaged distribution lines by rerouting power flows around severely damaged lines within the area of a township or two.

Make no mistake, constructing transmission and distribution tie-lines raises the cost of providing electric service relative to not having them.

For example, South Central's transmission has 32% more miles of line than the minimum necessary to provide service under normal conditions. This extra transmission investment raises the cost of electricity you purchase by about 3% to 4% at most.

The additional cost related to building and operating distribution tie-lines is harder to estimate because there are so many miles of them. The additional miles required are only a small percentage of the 2,200 miles of distribution lines the district owns. However, to be of value, distribution tie-lines have to be larger than standard distribution lines. The impact on retail rates is probably somewhere between 2% and 3%.

For our system, the overall retail rate impact of transmission and distribution tie-lines is probably around 5% to 7%. A small cost for the value they provide. Tie-lines not only reduce outage time during storms, they also reduce outage time for routine maintenance and construction. You never know about the outage you do not experience.

In the earlier comments about the "New Year's Eve" storm of 2006, I noted that **85% of our consumers lost power** during the storm. The **majority of those consumers had their power restored within 24 hours** by judicious switching of transmission and distribution lines.

Our third step in service restoration after a major storm is to secure additional labor/equipment and material. This actually happens concurrently with the second step discussed earlier. Information is gathered from consumer telephone calls, observations by our crews, and sometimes, a "quick" engineering survey. We then contact contractors, ask for "mutual aid" from sister utilities through the process established by the Nebraska Rural Electric Association (NREA), and order poles and material from vendors.

The 2006 storm became "major" around 3:30 am New Year's Eve after winds gusting 40 to 60 mph hit the area, taking down power lines already heavily loaded with ice. Holler Electric and Crowl Tree Service were in our office before sunrise, I contacted NREA for mutual aid at 5:44 am, and we ordered several hundred poles to be drop-shipped to strategic locations in Webster and Clay Counties later that same morning.

The fourth step in service restoration after a major storm is to reenergize damaged transmission and distribution lines. This step almost always begins before the second step is complete, as lines in some areas are more damaged than others. This effort ramps up rapidly as crews finish transmission switching and as the manpower secured in the third step arrives on-site.

Early in the storm, we pull poles and material out of stock on hand. Poles and material that is ordered in step three can arrive 3 to 5 days after ordering it.

A crew will work from the substation "down" each distribution feeder line restoring service as they go. Each distribution substation supplies power to multiple distribution feeder line circuits and there is a circuit breaker in the substation for each distribution line exiting the substation.

Many of the distribution feeder lines leaving substations also serve the dual purpose of being part of a tie-line to a neighboring substation. If either of the tie-lines between neighboring substations are damaged, the most severely damaged section of line becomes the temporary "new" open point between the substations and the sections of feeder/tie-lines between the substations and the "new" open point are repaired as needed so they can be energized.

If you were to drive along a distribution feeder line as it leaves a substation, you would find many lighter duty distribution lines that attach to the feeder line to distribute power into the countryside. There are usually multiple circuit breakers, sectionalizers and fuses in and along a feeder line and the distribution lines it serves. The purpose of the protective apparatus is to limit the number of people affected by a line outage and to shut the power off for safety's sake if a conductor goes down.

The District operates enough power lines to reach from Baltimore, Maryland to San Francisco, California. Somewhere around 45,000 poles support those power lines and hundreds of thousands of insulators and line hardware components are mounted on the poles. This is a lot of opportunities for trouble.

Power restoration can be slow, tedious, hard, and at times, thankless work; how slow and tedious depends on the severity and extent of the damage to the distribution system. Heavily damaged sections of line and consumers whose services are heavily damaged are sometimes passed by during this phase of the work in the interest of getting as many people on as fast as possible.

The fifth step in service restoration after a major storm is to reenergize distribution lines and individual consumers bypassed during the fourth step.

This work usually begins before the fourth step is completed. The following is from the report for FEMA from the New Year's Eve storm: *"By mid-morning January 4, 2007, only about 6 miles of line needed to serve 2 residential services were still off in Nuckolls County. In Webster and Adams Counties, about 111 miles of line needed to serve 117 residential services were still out of service. In Clay County, about 73 miles of line needed to serve 64 residential services were still out of service. Of course, hundreds of electric services for livestock, grain storage/handling, and irrigation were still off as well and would be for weeks to come."*

In the above paragraph, we identified 190 miles of line that needed repaired to restore service to only 183 residential consumers. We still had a little over one mile of line to repair per consumer.

The sixth step in service restoration after a major storm is to reenergize non-residential accounts on damaged lines.

Our initial focus is to restore service to residential accounts. Most non-residential accounts get their power restored while we are working to restore service to residential accounts by virtue of the fact that they are usually served from the same lines that serve residential accounts. The other non-residential accounts have electric service restored now.

The seventh step is to restore the electrical system to its original configuration.

This work can take months; sometimes more than a year to accomplish, but must be completed. Every line, every pole, every piece of hardware, is there for a purpose. Operations cannot get totally back to normal until all repairs are made.

CURRENT COMMENTS
Newsletter of the
SOUTH CENTRAL
PUBLIC POWER DISTRICT
Nelson, Nebraska
NOTICE
The regular meeting of the board of directors of South Central Public Power District is held the third Tuesday of each month at 9 a.m. at the district's office in Nelson, Nebraska.
Current Comments Editor: Royce Schott

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