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After Action Review

Event: Winter Storm Elliott **Event Date:** December 23, 2022

Straight-line winds and extremely cold temperatures moved through the LG&E and KU service areas between 12/22 and 12/24. Most customer outages were restored before the end of the day Saturday (12/24).

Summary Recommendations:

This section is considered an Executive level list of recommendations based on the information provided below. This information is consolidated into one master document and then the team agrees on the Summary Recommendations.

What went well (Provide a list of activities that went well during the restoration process):

1. Storm planning and resource staging prior to the event was effective. We had sufficient resources available, despite the day of the event being a company holiday, to perform swift restoration.
2. Very good turnout from LG&E and KU and contract workforce.
3. Incident command structure was structured well and with appropriate coordination of resources. Calls begin >24hr prior to the start of the event coordinating activities.
4. Good coordination with peer opcos. PPL EU and RI Energy needed resources during this event, and while we were unable to provide personnel, we were able to provide material. Daily calls with other opcos were effective to coordinate shared support needs.
5. Very good engagement with media and with PSC, particularly Brian Claypool, during the event. This was a highly watched event in the media. These comments exclude subsequent load-shed media coordination.
6. No safety concerns or near misses were identified within Transmission.
7. Coordination and teamwork between TCC, Generation Dispatch, DCC, and field personnel.
8. Coordination with LSEs (OMU, KMPA, and KYMEA).
9. Coordination with Reliability Coordinator (RC-TVA).
10. ESCs were well prepared and able to successfully implement established operating plans to address system emergencies throughout the event.
11. ESCs and Engineers worked well together to manage multiple N-1 issues occurring simultaneously
12. NERC Reporting (Initial report 1 hour and final report 72 hours later).
13. No staffing issues: management, additional ESCs and support staff present in the control center during the event and engineers provided additional support remotely.
14. Load shed tool provided energy relief needed.
15. Load shed implementation was well coordinated and communicated among GD and TOP/BA allowing for ACE to remain around zero (not dragging on the grid).
16. Information sharing by EDO.
17. Safety taking the lead on photos. This helped expedite getting them posted to social, which is a key way we're able to convey the challenges our crews are facing in the field as well as the conditions they are working in.

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18. Customer Experience section status report creation, prior to the Weather call, was helpful to get an update from various areas.
19. Prep calling Key Account (KA) customers of the storm coming and our preparation and support of them.
20. Distribution Automation, Distribution SCADA, and microprocessor relays expedited restoration efforts for loading challenges, with the ability to remotely change settings. This was a big positive impact during the load shedding event.
21. DCC did a good job managing calls and stacking calls on LineTechs were minimal.

What did NOT go well (Identify problem areas that occurred without any specific recommendations on improvement):

1. Cold weather resulted in equipment tripping out on high loading. Including Lemons Mills and the Alexander substations. A large number of the customers affected by the storm were interrupted as a result of equipment tripping out under load vs line faults.
2. Several safety events, including frostbite, Pineville MVA, parking lot MVA, etc.
3. Several personnel in key IC roles were out-of-office in the days prior to the storm because of the holiday and wanted to participate on as as-called-upon basis, vs actively staffing their IC role.
4. ERTs were suppressed until late afternoon on Fri (12/22). Need to come out of suppression sooner, particularly with extreme cold conditions.
5. It was found that some of the trips initiated for overload were the result of mismatches between the expected and actual ratings.
6. Communication with Key Accounts.
7. Public appeal occurred after the load shed rollouts began.
8. TCC did not have an understanding prior to shedding load that DCC was going to open Distribution feeder breakers after Transmission breakers were opened.
9. Ability to purchase power in an emergency situation. MISO said we could not buy from them since we did not have a BA/BA agreement. (Will follow up with Policy and Tariffs).
10. Activation of crews in RoD in KU areas was a struggle due to difficulty contacting RoD dispatchers. Central group had the rosters preloaded for the centers, but few RoD dispatchers were available at the centers to activate company and contractor crews working. Work Planning lead began reaching out on Tuesday to alert dispatcher of incoming weather and need for assistance.
11. Isolated communication challenges between DCC and Operations regarding outage causes. DCC was indicating a fault on the system and field operations was suggesting the cause was load related.

Comments/Suggestions to Improve (Identify what can be done to improve things that did or did not go well based on the comments above):

1. Assess whether high-load should be an alarming condition or an automated tripping condition. With telemetered devices, control center can weigh risks of tripping vs running past ratings if high-load is an alarming condition. Similar to high-temp alarms for transformers.

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2. Reinforce with IC members that: 1) emergency response is a command-and-control structure w/ IC at top, and 2) emergency response takes precedence over anything else, including personal plans. If you're the lead, then that is your primary function.
3. Establish better operational coordination between DCC and TCC for joint events.
4. Clarify the single-source-of-truth for equipment ratings and revise field device settings and OMA settings where discrepancies exist.
   Conduct a full review of the LG&E/KU Transmission Load Shedding Standard program / process, including ownership. Owner: Steinmetz
5. Review and update as necessary the LG&E/Capacity and Energy Emergency Operating Plan. Owner: Jackson.
6. Consider a defined LG&E/KU Power Conservation Alert Process/Program. Owner: McFarland.
7. Develop and execute the necessary Corp Awareness Training for any New or Updated Transmission Operating Plans/Programs. Owner: Steinmetz.
8. Incorporate any New or Updated Operating Plans/Programs (Transmission & Other) into the 2023 Grid Ex where they will be exercised. Owner: Steinmetz.
9. Address all follow-up items that may result from the Distribution After Action Review, creating sub teams as needed. Owner: Steinmetz/Jackson/Meacham.
10. Work on BA/BA agreements with MISO on being able to purchase emergency power. (Owner: Jackson/Ramos).
11. Routine Compliance Review of the Event. Owner: Hall/Colvin.
12. Look at enhanced PPE to protect employees from extreme cold weather (safety glasses, face coverings & hand protection).
13. Implement a work/rest standard when temps hit in the negatives.
14. Operating vehicles on ice, which ties into overall drivers training that is needed anyway.
15. Review with field resources the issues and mitigation methods they may encounter with the extreme cold temperatures that they would normally not encounter during restoration – i.e., loading issues, cycling reclosers/breakers, equipment freezing, etc.
16. Continued updates on weather/resources/plans moving into weather event are always appreciated. These can help us determine needs and timing for associated messaging such as safety, preparedness, mutual assistance and readiness and impact and restoration.
17. Continue to provide visual assets.
18. Storm wrap with final ERTs, summary of areas of greatest impact storm ranking (when appropriate) is great info as well.
19. Outage map – did outages related to rolling blackout indicate that as reason?
20. Enhanced situational awareness for Operations and DCC regarding load related challenges and process for resolving. Being our first "primary load related" event since the implementation of distribution automation, greater understanding of system capabilities would help in the future.
21. Enhanced process for tracking locations where larger fuse sizes are used during abnormal conditions. A single owner (DCC?) would help with post event follow up to "return to normal fuse sizes". Currently we rely on individual processes at the Operation center level to track these.
22. Pairing trouble men went well?

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Operations and Outages:

1. Actual out: 12/23/2022 01:09:45 Actual In: 12/23/2022 01:09:46. Line/Equipment: Delvinta to Lake Reba Tap 161kV line and West Irvine 161/69 Transformer. Weather: 38 degrees, 31 mph winds (W), 49 mph gusts, Conditions- Light Rain. Customer Impact: None
2. Actual out: 12/23/2022 01:14:35 Actual In: 12/23/2022 11:40:00. Line/Equipment: Delvinta to Lake Reba Tap 161kV line and West Irvine 161/69 Transformer. Weather: 38 degrees, 31 mph winds (W), 49 mph gusts, Conditions- Light Rain. Split section between Delvinta 139 to West Irvine 193 everything checked ok. Then tested to Lake Reba Tap 162 and everything held. Transmission Lines was going to send crews out, but Line tested good. Substation crews Checked Lake Reba Tap 804 for low Air pressure/ Breaker Air system froze up and maintenance resolved issue. Customer Impact: None.
3. Actual out: 12/23/2022 07:39:17 Actual In: 12/23/2022 10:16:00 2h 36m 43s. Line/Equipment: Brown Plant 728 to West Cliff 712 138 kV LINE and West Cliff T02 138/69 KV Trans. Weather: -6 degrees, 20 mph winds (WSW) , 29 mph gusts, Conditions- Foggy. Cause: Gas Pressure switch froze. Customer Impact: None.
4. Actual out: 12/23/2022 14:14:57 Actual In: 12/23/2022 15:37:00 1h 22m 3s. Line/Equipment: Paynes Mill to Tyrone 69kV line, Paynes Mill to Pisgah 69kV line. Weather: -1 degrees, 17 mph winds (W) , 30 mph gusts, Conditions- Light Snow. Cause: Over Current settings set wrong on the low side. Customer Impact: Paynes Mill 1298, 1 hr. 32 min.

Name: _____ **Role:** _____ **Date:** _____

Please return Completed form(s) to Dan Hawk, via email at [redacted] or via house-mail (BOC I). Submitted forms will be reviewed by the Emergency Preparedness and Response Team for to identify and act on improvement opportunities.