LG&E/KU Transmission Load Shedding Standard

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LG&E/KU Transmission Load Shedding Standard

Procedure Title

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Introduction and Scope

Per EOP-011-1, A Balancing Authority and Transmission Operator operating with insufficient generation or transmission capacity must have the capability and authority to shed load rather than risk an uncontrolled failure of the Interconnection. Requirements under this standard also require each Transmission Operator or Balancing Authority to have plans for operator controlled manual load shedding to respond to real-time emergencies. The Transmission Operator or Balancing Authority shall be capable of implementing the load shedding in a timeframe adequate for responding to the emergency.

This project was developed between Transmission and Distribution to define a criterion for load shedding Transmission radial loads and distribution transformers and to enhance the tools used by the Transmission Operator and Balancing Authority to meet compliance with EOP-011-1. The intent is that, in case load shedding is necessary, pre-defined groups are de-energized to alleviate the system emergency. By defining groups, Transmission Operations and/or Distribution Operations will have the ability to alternate or rotate outages more easily, preventing certain customers from taking the brunt of an emergency situation.

Circuits were chosen for this tool based on where telemetry and control is available through the Energy Management System (EMS). A scoring system based on customer criticality was developed to identify which circuits to avoid, which circuits to shed first, and which to shed last. Under Frequency Load Shedding (UFLS) circuits were also identified so that they could be avoided where possible. Finally, circuit loading based on peak loads in 2021 was captured for each circuit to identify the amount of load that would be shed under peak conditions.

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Objectives

Primary objective:

- Identify transmission radials where telemetry and control are available
- Identify critical loads to be avoided during load shedding
- Identify UFLS circuits
- Develop a scoring system to be used in ranking circuits for use in the load shed tool.
- Create an enhanced tool, implementing identified LG&E and KU transmission for load shedding.

Secondary objective:

- Create a spreadsheet that can be used to identify critical customer, major customer, and the peak load on each circuit

Deliverables

- Evaluate & develop a criterion and standard to select load shedding radials and transformers
- Create spreadsheet containing information about radials and transformers
- Create pre-defined groups to alleviate a system emergency
- Create new EMS displays for load shedding
- Retire current EMS displays

Transmission Load Shed Criteria

For a load to be evaluated as a part of the load shed plan, it must be fed through a breaker with telemetered indication and control, and it must be fed radially so that one operation de-energizes said load.

Customer Scoring Weight Criteria

A score board was developed to identify the criticality of each feed, which would then be used to determine the criticality of the loads on the transmission system. The score board categorized critical loads as, airports, defense customer, environmental, hospitals, media communication, nursing homes, public emergencies, and utilities. Major customers, schools, and medical alert programs were also included within the categories in the score

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board. Each category was assigned with values from 1 to 5, 5 being the most critical. See table below for the criticality assigned to each load.

Group	Gas Supplying Generation	MAP	Hospital	Nursing Home	Water	Public Emergency	Airport	Defense	Environmental	Utility	Transportation	Media Communication	School	Major Customers
Critical Gas	1													
MAP		1												
Critical 4			2	1										
Critical 3					2	1								
Critical 2							2	1						
Critical 1									4	3	2	1		
Key Customer													1	1

The number of customers for each feed under each category were also identified. Once all the data was collected, the number of customers on each circuit for each category was multiply by the category critical value, then the results of each category were added together to get a final number for a single circuit. Next, the criticality scores of the breaker were determined by combining the criticality scores of each circuit being fed out of the transmission system by that breaker. The higher the value, the more critical a load is. The load shedding groups were then created from a low criticality score to a high criticality score.

UFLS

NERC developed PRC-006-5 standard, which focuses on Automatic Under frequency Load Shedding (UFLS). The purpose of this standard is to establish design and documentation requirements for UFLS programs to arrest declining frequency, assist recovery of frequency following under frequency event and provide last resort system preservation measures.

As a result, UFLS should be avoided in the load shedding plan if possible.

The DCC Engineering were provided with a list of potential loads, and evaluated the list to determine if the breaker fed a UFLS load. This list mentions three different groups of

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UFLS breakers, one to three. The first group trips when frequency decays to 59.5Hz, the second group when frequency decays to 59.3Hz, and the last group when frequency decays to 59.1Hz. UFLS breakers were identified in the score card with a 1, 2, or 3 depending on which group they belong to. The higher the UFLS group breakers belong too, the sooner they will be shed.

Load Information

The load values shown on the Load Shedding Standard (Transmission) display reflect the real time load value obtained from the SCADA system. If real time load information was not available through SCADA, then the values were pulled from the State Estimator. The Total MW load at the bottom of each group is calculated by the summation of each individual load.

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Revision History

Rev. No.	Change:	Prepared By:	Effective Date:
0	Initial document reformatted from existing Load Shedding Standard	B. O'Hara	6/1/2022

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