

Lesson Learned

Auxiliary Power Loss to STATCOM Leads to UVLS Operation

Primary Interest Groups

Transmission Operators (TOPs)
Transmission Owners (TOs)
Reliability Coordinators (RCs)

Problem Statement

A voltage disturbance on the transmission system led to the loss of redundant auxiliary cooling system power sources for a static synchronous compensator (STATCOM), causing the STATCOM to trip. Both auxiliary cooling power supplies were fed from the same high-voltage substation. The loss of the STATCOM exacerbated a low-voltage condition on the transmission system. Undervoltage load shed (UVLS) relays on distribution feeders in the area tripped as a result of the low voltage, shedding 92 MW of firm load.

Details

A STATCOM's auxiliary power is critical to operating its cooling system, which has two pump motors that circulate coolant through the power electronics. During normal operation, one cooling pump runs and the other remains on standby. If the power to the circulating pump is disturbed, a transfer switch will operate to switch to the backup feed and pump.

A post insulator for a 138 kV transmission line failed, causing the line to fall across the 138 kV bus at the substation. Protection system misoperations resulted in the loss of two additional 138 kV transmission lines. A STATCOM, rated at +/- 150 MVAR, was connected to a substation approximately 22 miles from the faulted substation bus.

In this event, both of the auxiliary power supplies to the STATCOM's transfer switch were fed from the same transmission source. When the disturbance affected both feeds, the transfer switch did not have a good source to transfer to. This caused the transfer to fail and the cooling system to trip off. As a result, the STATCOM tripped off to protect the power electronics from the loss of cooling. Relay data available for the event shows voltage on the transmission bus that the STATCOM was connected to lowered to 0.7 per unit.

The trip of the STATCOM exacerbated the low-voltage condition in the area, causing the loss of an additional 57 MVAR capacitor bank. Undervoltage load shed relays on distribution feeders in the area, set at 0.85 per unit with a two second time delay, responded to the low voltage and tripped 92 MW of firm load.

Corrective Actions

An uninterruptible power supply (UPS) was installed to supply the STATCOM auxiliary equipment.

Lesson Learned

Design philosophy for a device that protects BPS voltage should ensure that a voltage disturbance cannot prevent the device from functioning as intended.

The auxiliary power system is critical to the proper operation of STATCOM equipment. Proper system design should ensure that auxiliary power sources are redundant and fed from sources that are electrically separated from areas that need STATCOM voltage support. If that is not feasible, a UPS should be considered.

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