

Coolkeeragh Busbar Coupler and Section Switches

Needs Report

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SUMMARY

There is presently only one bus coupler and set of bus section switches on one of the busbars at Coolkeeragh, which are not directly side by side, as seen in Figure 1. The lack of a second busbar coupler compromises the reliability of the substation for busbar or bus coupler faults when compared with other similarly sized 110kV substations which have two bus couplers and bus section switches on both bars. With the present arrangement at Coolkeeragh, a fault on the bus coupler would result in the disconnection of the whole 110kV switchboard leading to major loss of supply to the north west of Northern Ireland.

This report sets out the case of need for establishing a second bus coupler and suitably spaced bus section switches on both busbars.

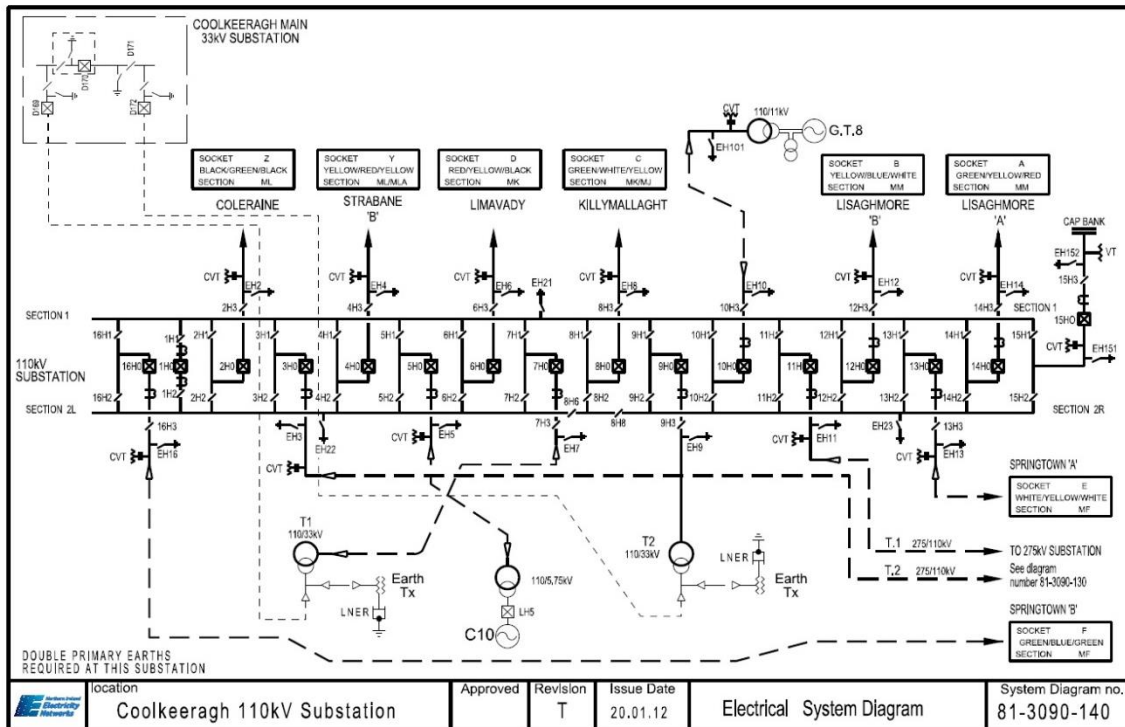


Figure 1 Coolkeeragh 110kV Single Line Diagram

1. INTRODUCTION

With only one bus coupler and no means of connecting a second the substation is at risk of a single event which would disconnect the whole 110kV switchboard. A fault on the busbar coupler would disconnect the Coolkeeragh node, including the city of Derry/Londonderry, the steam turbine and potentially the gas turbine. The renewable power at Limavady, Coleraine, Strabane and Omagh would become sectionalised and would to flow from the northwest via the remaining in service 110kV circuits, which would become overloaded.

The arrangement at Coolkeeragh does not comply with the busbar design recommended by the TSSPS prior to its revision in 2015.

Furthermore, the updated TSSPS requires that following the fault outage of any single busbar coupler circuit breaker the loss of power infeed shall not exceed 1.3 times the largest single infeed, i.e. 650MW. While this type of fault is rare the impact at Coolkeeragh would be significant. In a scenario with levels of renewables required to reach the 80% target a bus coupler fault at Coolkeeragh could result in overload of 110kV circuits, with the risk of cascade tripping and potential loss of all renewables in the north west, which would be in excess of the spinning reserve. The result would be the loss of generation well in excess of the 650MW and high levels of load shedding.

The second bus coupler will become even more critical in future as further generation and demand connects at the site.

2. DESCRIPTION OF NEED

Coolkeeragh was originally designed with two bus couplers, however the coupler at the west side was removed to allow the capacitor to be connected as it was considered to be more critical to system operation at that time and there was no other way of connecting it. While the substation arrangement with one coupler was put in place it would not have complied with Design Memorandum 09/55¹ which was part of the TSSPS at the time.

A fault on the busbar coupler would trip the 110kV busbars leading to the disconnection of all supplies to the city, the tripping of the steam turbine and the disconnection of the Coolkeeragh - Magherafelt 275kV double circuit. There is also a high probability that the GT would also trip. In this scenario all the renewables being generated in the area would flow back to Kells and Tamnamore via the 110kV circuits. Studies with 70% of wind in summer peak show these circuit become overloaded, which would then be tripped by protection, leading to loss of high levels of renewables and loadshedding.

The TSSPS requires that following the fault outage of any single busbar coupler circuit breaker the loss of power infeed shall not exceed 1.3 times the largest single infeed, i.e. 650MW. A bus coupler fault at fault at Coolkeeragh resulting in loss of renewables in the northwest and C30 would exceed this standard.

¹ This standard required two couplers and four separate busbar sections for substations with more than six circuits.

The winter peak demand that would be automatically disconnected for a bus coupler fault at Coolkeeragh would be approximately 108MW with a repair time of up to 10 hours, as well as additional demand that would be shed due to the loss of renewables due to overloads on 110kV circuits. This outcome would be unacceptable and represents a high risk.

There is a need to reinstate the second bus coupler and bus section switches to at least the standard of other similarly sized substations in Northern Ireland. To do so would require bus section switches side by side on each busbar.

The need to increase security of the substation is included in the internal Transmission Investment Plan (TIP) and will be included in the next version of the TDPNI.

3. CONCLUSION

Coolkeeragh 110kV has a reduced security when compared to other substations of that capacity. A single fault on the bus coupler would lead to a disconnection of the whole substation and loss of supply. The loss of the node would also lead to the disconnection of the steam turbine and probably the gas turbine also. The sectionalising of the 110kV system could also lead to the overload of 110kV circuits in the north west with the potential for cascade tripping, further loss of renewables and load shedding.

There is a need to increase the substation security to ensure it has an appropriate number of bus couplers relative to the number of circuits and size of demand and generation connected at Coolkeeragh 110kV.