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Investigation into the Issues Associated with closing an automated Normally Open (N/O) point on three Medium Voltage (MV) Networks where Fault Location, Isolation and Service Restoration (FLISR) is planned

Dissertation

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Abstract

The design of Medium Voltage (MV) Overhead Lines (OHLs) in the electricity distribution industry is often radial in nature which makes back-feeding difficult and these networks are often long which increases their exposure to faults. This has resulted in poor network reliability. Customers are mainly affected by faults on the MV network, to which particular attention has to be paid. Permanent faults have negative impact on customers since they experience outages or interruptions. The impact on customers increases when these outages are long. The network reliability is reducing and the cost to customers is increasing. Customers are demanding higher levels of quality of supply from the distribution network. As the global energy study is working on achieving the seventh Sustainable Development Goal (SDG 7), it is important to have a reliable power supply to improve socioeconomic development to customers and this will be a stepping stone in achieving other SDGs. Digitalization is one of the factors affecting electricity networks towards a clean energy future and automatic service restoration is one of the most important strategies for Distribution Automation (DA). Therefore it is necessary to implement self-healing Smart Grid technologies. One such solution is Fault Location, Isolation and Service Restoration (FLISR). The main drive towards FLISR is to improve Eskom's network performance, improve electricity sales, flexibility and accessibility and reduce impact on the economy of outages as well as to support trends towards a more sustainable energy supply. This research investigates various ways to implement FLISR and it focuses on case studies on real distribution networks and looks at the issues associated with closing a remotely controlled or automatically operated Normally Open (N/O) point for back-feeding. The complete algorithm and procedure of auto-restoration are discussed. The results on case studies discussed in this dissertation show that a remotely controlled N/O point can be installed without constraining the network to reduce restoration time following a fault. This is assured by not violating network's electrical requirements such as voltage levels and feeder thermal loading.