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BLACK START-UP STUDY OF THE INTERCONNECTED SRI LANKAN POWER SYSTEM

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In the past, the Jaffna Medium – Voltage (MV) network was supplied by isolated thermal generation, which was more expensive compared to hydro generation. According to the recent development plan in the electrical sector, MV network in the Jaffna peninsula is now being connected to the national grid. This connection is expected to be completed by August 2013. Interconnection with the national grid will reduce the cost of generation and also will strengthen the Jaffna MV network. This paper discusses the black start-up operation of the Sri Lankan power system with the placement of a Static VAR Compensator (SVC) in Killinochchi.

In the interconnected Sri Lankan power system, Jaffna load centre will be located far away from the generation centre with the longest transmission (224 km) placed in-between Anuradhapura and Jaffna. As a result of this, proactive work may need to be done to investigate the possibility of having (i) power fluctuation, (ii) voltage flickering, (iii) amount of transmission loss, and (iv) black-start up. In this paper, black start-up is considered as a main characteristic, which is affected by the interconnection of two power systems. This study mainly focused on the black start-up operation of the interconnected network predicted in 2016. Predicted Sri Lankan transmission network and Northern Province MV networks in 2016 were modelled using IPSA simulation tool. An equivalent simplified circuit of the transmission network was modelled using EMTDC/PSCAD simulation package. This equivalent circuit contains grids such as, New Anuradhapura, Vavuniya, Killinochchi, Mannar, and Chunnakam. The transient behaviour of the network was studied with and without reactive power compensations. The authors of this paper have published the steady state operations of the network in an *IESL Annual Transaction* in 2012.

In this study seven circuit breakers were used to turn on and off the power plants and loads at specified times. Black start-up studies were done with and without reactive power compensation. Usually, when a power system is re-energized after facing a blackout, the bus-bars will experience either over-voltage or under-voltage which may lead to trip the circuit breakers. Therefore the black startup process will become difficult to achieve. In such cases, a dynamic voltage compensator can be useful. The SVCs are better than other modern reactive power compensators as far as the cost and long-term performances are concerned. In the Sri Lankan power system, an SVC was operational in Galle, but is currently no- functional. In this simulation study an SVC was modeled and placed at the Killinochchi bus-bar. The SVC control was developed using PI-controller based feedback system in EMTDC/PSCAD.

This study shows that the placement of SVC at the Killinochchi bus-bar gives better performance by improving black start for the predicted network in 2016. Also, it improves the voltage profile of the system by solving over-voltage and under-voltage problems. As a result, SVC makes the system more controllable for transient effects.

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