UNDER FREQUENCY LOAD SHEDDING FOR POWER SYSTEMS WITH HIGH VARIABILITY AND UNCERTAINTY

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ABSTRACT

Emergency load shedding for preventing frequency degradation is an established practice all over the world. The objective of load shedding is to balance load and generation of a particular Power System. In addition to the hydro and thermal generators each with less than 100 MW, today, the Power System of Sri Lanka is comprised of three coal Power Plants: each has a generation capacity of 300 MW, Yugadanavi combined cycle Power Plant (300 MW generation capacity) and a considerably extended transmission network. To cater consumers with high quality electricity, a reliable Power System is a must. Therefore, it has become timely necessity to review the performance of the present CEB Load Shedding Scheme and suggest amendments where necessary.

The objective of this research is to explore a better Under Frequency Load Shedding Scheme (UFLSS) which can face probable contingencies and maintain stability of the system while catering more consumers. The suggested UFLSSs can address the recent changes taken place in the Sri Lanka Power System too.

A simulation of the Power system of Sri Lanka was designed with software PSCAD. Its validity was checked through implementing actual scenarios which took place in the power system under approximately-equal loaded condition and by comparing the simulated results and actual results. Then a performance analysis was done for the Ceylon Electricity Board (CEB) Under Frequency Load Shedding Scheme which is being implemented in Sri Lanka. Having identified the drawbacks of the CEB Under Frequency Load Shedding Scheme, the new UFLSSs (LSS-I and LSS-II) were suggested.

The Load Shedding Scheme – I (LSS-I) is designed based on power system frequency and its derivative under abnormal conditions. Without doing much modification to the prevailing UFLSS, and utilizing the available resources, the suggested LSS-I can be implemented.

The LSS-II gives priority for 40% of the system load for continuous power supply, and it is comprised of two stages. During the stage-I, approximately 30% of the load is involved with the Load Shedding action. During the stage-II, the disintegration of the power system is done. This involves the balance 30% of the load. At 48.6 Hz the disintegration of the power system takes place. By disintegrating the power system at the above mentioned frequency, all islands as well as the national grid can be brought to steady state condition without violating the stability constraints of the Sri Lanka power system. During disintegration of the Power System, special attention must be paid for:

- Generation & load balance in each island and in the national grid.
- Reactive power compensation in islands and in the national grid.
- Tripping off of all isolated transmission lines (which are not connected to effective loads).

Through simulations the effectiveness of the UFLSSs were evaluated. They demonstrate better performance compared to that of the currently implementing CEB scheme. Results highlight that the UFLSS should exclusively be specific for a particular Power System. It depends on factors

such as power system practice, power system regulations, largest generator capacity, electricity consumption pattern etc.

To my parents

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