CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Load shedding serves as the ultimate guard that protects the power system from a contingency [4]. It is a logical thought by some ways and means the load shedding has to be minimized [1].
Under Frequency Load Shedding (UFLS) mechanism used by CEB has common drawbacks such as lack of detailed system data before disturbance and after disturbance. Due to this unawareness, incorrect and mostly excessive load shedding occur.

In response to a dip or rate-of-change in frequency, frequency relays operate a set of fixed circuit breakers, independent of their actual operating load [4]. Some feeders might not be energized at the time load shedding is required. As UFLS scheme is totally independent of the system dynamics, total loss of the system is also a possibility.

This dissertation discussed about designing of Intelligent Load Shedding (ILS) mechanism which will shed optimal load after a disturbance considering demand at each feeder. After analyzing historical failures occurred in the system, weaknesses of the existing load shedding scheme-UFLS were identified. A model has been built in MATLAB software with GUI to analyze the operation of ILS at different failures.

In order to conduct a better comparison, both load shedding mechanisms UFLS and ILS were applied in PSS/E software which is the software tool used by CEB for power system studies. Result analysis was done comparing results obtained under three case studies through application of UFLS and ILS.

Through application of ILS to CEB network, following major benefits can be achieved;

(1). Probability for a total failure is reduced.

(2). Number of feeders getting interrupted is reduced.

(3). Quantity of real power curtailed is reduced.

(4). Voltage profile during contingency period is improved.

(5). Contribution to SAIDI and SAIFI reliability indicators is reduced.

From above mentioned benefits, benefits mentioned under (4) and (5) require further studies.

Apart from that each mentioned benefit is proved through results obtained in PSS/E simulation.

According to the following equations for the calculation of SAIDI and SAIFI reliability indicators, it can be proven that these indicators are getting improved through application of ILS. This is mainly due to number of feeders getting interrupted is reduced under ILS mechanism.

$$SAIDI = \frac{Sum\ of\ all\ customer\ interruption\ durations}{Total\ number\ of\ customers\ served}$$

$$SAIFI = \frac{Total\ number\ of\ customer\ interruptions}{Total\ number\ of\ customers\ served}$$

5.2 RECOMMENDATIONS

SCADA (Supervisory Control and Data Acquisition) is to be implemented in CEB system by the end of the year-2016. After completion of SCADA implementation, communication is possible within control centre, grid substations and power stations. Controlling of remote equipment, remote data monitoring and access, alarm handling, data examination and also taking actions depending on online status of the system are some possible activities in a SCADA facilitated-system.

It is recommended to apply 'intelligent load shedding' (ILS) mechanism after successful implementation of SCADA in CEB network. A separate server has to be maintained in Control Centre named 'ILS real-time server' which downloads the time-variant load shedding tables to each PLC located near grid sub stations where loads can be shed. A default priority load shedding table is also to be written to the PLC to use in the event of communication failure between the ILS server and PLC. Frequency relays are also required to be remained in the system.

Data collection servers are also required to be installed in the sub stations and power stations to update ILS server about demand and generation continuously. For accurate data acquisition Ethernet- equipped smart meters or intelligent electronic devices (IEDs) are required.

SCADA system which is to be implemented in CEB network follows STM-1 (Synchronous Transport Module level-1). The STM-1 is the SDH ITU-T fiber optic network transmission standard. It has a bit rate of 155.52 Mbit/sec [9].

With data transfer rate of 155 Mbit/sec, 19,375 kB of data can be transferred within 1 second. Within 100 milliseconds 1937.5 kB of data can be transferred which is almost more than 1 MB.

It is clear that optimal load shedding tables can be updated by ILS server within 100 milliseconds under operation of this data transmission module.

As all the calculations are done within the ILS server, if any modification is required to be done such as making feeder which is in low priority list as 'high priority' and removing from load shedding list, it can also be done in ILS server. ILS server should be properly maintained and a back-up server is also required to be installed to use in case of an emergency.

To overcome the weaknesses found in existing load shedding mechanism, it is recommended to apply 'intelligent load shedding' mechanism after proper implementation of SCADA and relevant servers in the CEB network.