Chapter 1

INTRODUCTION

1.1 Background

Considering the benefits from electric power systems to the human life, it is a sole responsibility of the utility to secure reliability of this electric power system in every possible way. Through power system blackouts a large group of consumers is left without electrical energy for some time duration. At any critical situation operator has to shed down excess load to gain power system stability. This process is called "load shedding" which keeps the system stable until the fault is cleared. Requirement for shedding the optimum amount of load is high nowadays which results in minimum interruptions due to a contingency.

1.2 Requirement of the load shedding scheme

Mainly due to a generation loss through tripping of any generator connected to the system or excess generation through tripping of transmission lines, system frequency deviates from the permissible range. In Sri Lanka permissible range of system frequency is between 49.5 Hz and 50.5Hz. Without activation of load shedding mechanism, it may lead to total system collapse which will affect a large number of customers and it will take longer time period for the system recovery. Governors cannot respond quickly for sudden imbalances in generation and load. Therefore load shedding mechanism should get activated in a proper way to reduce system blackouts.

1.3 Motivation

Initially I studied the existing load shedding mechanism which is Under Frequency Load Shedding (UFLS) mechanism used by CEB. Further I studied some partial system failures and a major system failure occurred in recent past to identify the loop holes in the existing load shedding mechanism.

Through my study I found out major weaknesses of the existing load shedding mechanism as follows;

1. Excessive load shedding.
2. Inadequate load shedding which may lead to system collapse.
3. Occurrence of more feeder interruptions.
4. Same pre-defined load shedding table is used for off-peak, day-peak and night-peak (independent of time of the day).
5. Reactive power produced at each feeder is not taken into consideration.

Considering above major weaknesses, necessity for a more accurate load shedding mechanism is identified which can make a fast, optimum and reliable load shedding decision. The "intelligent load shedding" is a means enabling to improve power system stability, by providing a real time adapted load control and load shedding, in situations where the power system otherwise would go unstable[1].

In recent decades, the advantages of a fast development in the computer and communication technology have been successfully harvested in the majority of technological areas for updating various mechanisms and processes. Power system control and protection is no exception [6].

The outcome of this project is developing a load shedding mechanism to make an optimum and reliable load shedding activity.

1.4 Objectives

1. To devise a load shedding mechanism to handle contingency situations more effectively.
2. To build knowledge database for the selected CEB network in MATLAB software.
3. To model an algorithm to monitor system frequency and frequency deviation rate and to update optimal load shedding tables in MATLAB software.
4. To develop the algorithms to make an optimum and reliable load shedding activity through intelligent load shedding application to CEB network.
5. To analyze and compare the proposed load shedding mechanism-'intelligent load shedding' mechanism with existing load shedding mechanism-UFLS in 'Power System Simulator for Engineering'(PSS/E).

1.5 Methodology

1. Analyzing failures occurred in recent past and how the system has responded in such failure events.
2. Selecting a reduced network from CEB network to form a model in MATLAB software.
3. Collecting data related to the network and modeling data for the uploading purpose in MATLAB software.
4. Extracting load data of the feeders that can be shed.
5. Importing modeled data into MATLAB software.
6. Designing Graphical User Interface (GUI) in MATLAB software.
7. Developing the coding to update optimal load shedding tables and to activate load shedding through monitoring system frequency and frequency deviation rate.
8. Application of case studies in MATLAB software.
9. Analyzing results of existing load shedding scheme (UFLS) in Power System Simulator for Engineering (PSS/E) software tool.
10. Application of intelligent load shedding(ILS) in Power System Simulator for Engineering(PSS/E) software tool.
11. Result analysis through comparison of the results obtained for UFLS and ILS.

Validation of the proposed load shedding mechanism- 'intelligent load shedding' was done mainly through the results obtained through PSS/E as existing load shedding mechanism – 'under frequency load shedding' mechanism was also applied for the same case studies in PSS/E. After completion of SCADA system for the CEB network, application of intelligent load shedding is a possible action to be taken to improve system reliability.