Chapter 1

INTRODUCTION

1.1 Background

Power System reliability has gained utmost concern in modern era since it is one of the key elements of modern development. Main parts of the Power System are Generation, Transmission and Distribution. Each one of them has their own reliability improvement methods such as Protection systems, Condition Monitoring Systems, etc. but when we consider the system as a whole "Load shedding" is the main controlling method to keep up the system alive when it goes to unstable state which National Control Center unable to rectify. So having advanced Load shedding scheme is the prime importance in modern days and these Load shedding schemes should also capable to facilitate Islanding operation when system separates into regions due to limitations in the Network configuration during system faults.

1.2 Importance of the Load Shedding Scheme

When a Power System is in stable operation at normal frequency, the total mechanical power input from the prime movers to the generators is equal to the sum of all the connected loads which also includes all real power losses in the system [1]. If any significant unbalance occurs such as tripping of main generator in the system or tripping of main transmission line in the system will causes a frequency variations. These frequency variations occur due to slow down or speed up the rotors in the system. Normally rotors are massive rotating masses which have immense kinetic energy. When one of the main generators in the system trips, system will experience lack of generation than the loads so rotors slow down and kinetic energy converted into electric energy and supply to the system. As a result system frequency will drop. When main transmission line in the system trips, system will experience excess of generation than load so rotors speed up to absorbing energy. As a result system frequency will increase.

Governors in the generators sense small changes in speed resulting from gradual load changes in the normal system. These governors adjust the mechanical input power to the

generating units in order to maintain normal frequency operation [1]. But sudden losing of large generator can produce a severe generation and load unbalance, resulting in a rapid frequency decline. If the governors cannot respond quickly enough, the system may collapse. So rapid and selective shedding of loads can make system recovery possible and avoid prolonged system outage and restore customer service with minimum delay.

1.3 Identification of the Problem

Several procedures and criteria must be considered when designing load shedding scheme for specific systems. These include [1]:

a) Maximum anticipated overload
b) Number of Load Shedding Steps
c) Size of the Load Shed at each Step
d) Frequency Setting
e) Time Delay
f) Location of the frequency relays

So detailed study of existing Load Shedding scheme of Sri Lankan Power System with above settings is important.

When analyzing the historical data related to existing Load Shedding scheme; some of the above settings were not updated according to the system expansion (as an example during the period 2005 to 2012, Frequency setting and Time delay setting of Load Shedding scheme is not changed but Sri Lankan transmission network significantly expanded, generators such as Kerawalapitiya and Norochcholai connected to the system during the same period), some were implemented by foreign consultants according to their own standards without much concern about our network, some of the setting were implemented purely to overcome the blackout situations and further some of the setting were implemented case by case study with the similar system failures.

Due to above mentioned reasons and also analyzing the system behavior in last few years during system disturbance, it can be identified that proper analysis and implementation of new Load Shedding scheme is prime important in the present Power System point of view.

Further, due to the present Network configuration after certain Power System failures some part of the System isolates from the main system and operates in islanding Mode. This Islanding operation fails at all the times due to unbalance of the Generation and Load. So there is a necessity of rearrange the Load Shedding Feeders of each GSS to facilitate the possible Islanding operations in Sri Lankan Network.

1.4 Motivation

The outcome of this project will be to develop a Load shedding scheme which facilitate system recovery with minimum impact to the customers. Further, in the event of separation of the system into regions it will facilitate Islanding operation which enables to supply electricity to all the separated regions with minimum impact in their customers.

This Load shedding schemes will improve the Power System reliability and have a definite positive effect on customers which in turn improve the wellbeing of the people and economy of the country.

1.5 Objective of the Study

There are four objectives in this study,

1. Analyze Existing Load Shedding Setting such as,
    - Maximum anticipated overload
    - Number of Load Shedding Steps
    - Size of the Load Shed at each Step
    - Frequency Setting
    - Time Delay
2. Propose suitable Load Shedding Setting for Sri Lankan Network.
3. Identify possible Islanding operations due to present Sri Lankan Network configuration.
4. Rearrange the 33 kV Load Shedding Feeders in the Sri Lankan Network to facilitate the possible Islanding operations in Sri Lankan Network.

1.6 Methodology

1. Analyzing the Existing Load Shedding scheme using Power System simulator.
2. Propose suitable Load Shedding scheme using Power System simulator.
3. Identify possible Islanding operations due to present Sri Lankan Network configuration.
4. Analyzing the stability of the above identified Islands using Power System simulator (with the proposed Load Shedding scheme)
5. Rearrange the 33 kV Load Shedding Feeders in the Sri Lankan Network to facilitate islanding operation by analyzing the stability of the islands using Power System simulator (with the proposed Load Shedding scheme)

This study will help to find a feasible solution for the above section 1.3 mentioned problems and the results obtained through this study could be used to improve the present system reliability.