DESIGN A CONTINGENCY ELECTRICITY FEEDING PLAN
A CASE STUDY: DEHIWALA AREA

Gato Kandege Athula Kumara

(108887 L)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

April 2015

DESIGN A CONTINGENCY ELECTRICITY FEEDING PLAN
A CASE STUDY: DEHIWALA AREA

Gato Kandege Athula Kumara

(108887 L)

Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree

Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

April 2015

DECLARATION

"I hereby declare that this research is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Further, I hereby grant to the University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other media. I retain the right to use the content of this thesis in whole or in part in my future activities.

……

G. K. A. Kumara Date

The above candidate has carried out research for the Masters Dissertation under my supervision.

……..

Dr. Udayanga Hemapala.
Faculty of Engineering
University of Moratuwa

……

Date

ACKNOWLEDGEMENT

First, I pay my sincere gratitude to Dr. Udayanga Hemapala who encouraged and guided me to conduct this case study and on the preparation of final dissertation.

I would like to take this opportunity to extend my sincere thanks to Mrs. Indu Lokubalasooriya, Chief Engineer – Planning & Development (Western Province South - 1, CEB), Mr. Janaka Nuwansiri, Electrical Engineer – Planning & Development (Western Province South – 1, CEB) and the Staff of the Planning & Development Division (Western Province South – 1, CEB) for their valuable assistance to conduct my research successfully.

ABSTRACT

CEB is mainly Electricity Generating, Distributing and solely Electricity Transmitting organization in Sri Lanka. Few years back, main target of CEB was to achieve 100% electrification level and was not greatly concerned about the reliability of electricity supply. Presently Sri Lanka has achieved 96% electrification level [01]. It is expected to reach 100% with in next few years.

Presently CEB is providing electricity supply to 90% consumers and LECO is providing electricity to the remaining 10% consumers in Sri Lanka [02]. Once electricity is there the consumers will be more concerned about supply reliability.

Nowadays most human activities depend on the electricity supply availability. Therefore electricity service providers need to provide reliable supply to consumers. Electricity supply reliability can be improved providing N-1, N-2, and N-3 electricity feeding plans. At least CEB need to provide N-1 electricity feeding arrangement to their consumers.

Dehiwala area is selected for case study to observe the availability of N-1 feeding arrangement and find new proposals if it is not available. This study is done only for MV lines. All peak load details of transformers were collected and model the MV network for year 2014 through Synergee software. Then acceptable growth rate was applied and forecasted SynerGEE model for year 2020 was created. Based on that the availability of N-1 feeding arrangement for model of year 2020 was examined.

New suggestions have been proposed considering availability, construction ability and cost where N-1 feeding arrangement is not available. Cost estimation also was prepared these sites. SAIDI value has been calculated for before and after implementing the proposals. It is clearly noted that SAIDI is improved considerably after implementing the new proposals. Three common models are developed to extend this study for other Distribution areas.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVITIONS

Abbreviation	Description
A	Amperes
CEB	Ceylon Electricity Board
LECO	Lanka Electricity Company (Pvt) Ltd
GS	Grid Substation
PS	Primary Substation
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
F	Feeder
MV	Medium Voltage
kV	Kilo Volts
N/A	Not Available
Att	Attidiya
Dehi	Dehiwala
Kalu	Kalubowila
RMU	Ring Main Unit
AGA	Assistant Government Agents
LBS	Load Break Switch
Sw	Switch
SIN	Substation Identification Number
B	Bulk
D	Distribution
CSC	Consumer Service Centre

LIST OF APPENDICES

Chapter 1

INTRODUCTION

1.1. Background

Electricity is one of the most important factors for day to day life. Ceylon Electricity Board (CEB) is the organization, which mainly Generates, Distributes and solely Transmits Electricity in the Sri Lanka. Presently CEB has 5,210,000 consumers [01] and they use around 40 GWh per day with a peak demand of around 2100 MW. [10] CEB supplies Electricity throughout the day without any interruptions. Lanka Electricity Company (Pvt) Ltd (LECO) is the only other company who has license to distribute Electricity in Sri Lanka. They have 500,000 consumers [02]. It is around 10% of the total consumers.

CEB has a 3362 MW installed power capacity including Private Power Purchases. Power Consumption of Sri Lanka is 10,650 GWh per year and total revenue of CEB is around 190,488 million rupees per year. Transmission and Distribution losses are around 11% of net generation.

Generating Voltage of Power Plants is less than 20 kV. CEB uses two Transmitting Voltages, which are 220 kV & 132 kV. These are called High Voltage lines. Also CEB uses two types of MV lines as 33 kV & 11 kV. CEB owns and operates 500 km of 220 kV lines, 1900 km of 132 kV lines, 28700 km of 33 kV lines and 2400 km of 11 kV lines [01]. Sri Lanka uses 400 V for low Voltage. There are 121500 km low voltage lines available all over the country. Above Voltage lines can be overhead or underground. But most of the Voltage lines are overhead lines. Underground lines are available at Colombo city and some other major cities.

Present Electrification level of Sri Lanka is 96 % [01]. Sri Lankan Government has planned to achieve 100% Electrification level by year 2012. But due to several unfavorable circumstances it was delayed. Sri Lanka is expected to achieve 100% Electrification level within next few years.

1.2. Motivation for the Project

Interruption of Electricity Supply is common incident in Sri Lanka and it was not highlighted at few years back. Still it remains the same for rural areas. Urban population has a very complex life style and their life style depends largely on the availability of Electricity supply. Once people have the electricity, then they think about the reliability of the supply.

Working hours of most offices in Sri Lanka including Government and Private Sector depends on the availability of electricity. Backup power is found very rarely at Offices in Sri Lanka. Once an interruption occurs, almost all work will stuck till power comes back. If the electricity supply is not reliable, it is difficult to plan any work in the office including meeting, function etc. It can lead to a huge loss of productivity in the company or organization.

Industries largely depend on the reliability of Electricity supply. Most of the industries are having back up power supply. Unit cost of backup power supplies is really high compare to unit cost of CEB supply. Sri Lankan Government needs to encourage investors to start industries here. Establish the Free Trade Zones are one encouraging point and availability of reliable electricity supply without daily power outage with reasonable unit cost will be highly attractive.

Most of the electricity distribution lines are overhead lines. Breakdown of power distribution lines are very common. Maintenances of power lines are essential. Breakdown and maintenance need to be done affecting least number of consumers. Most of the planned interruptions are done during the weekends. It is really uncomfortable to the domestic consumers which they have planned all their house works during that time.

There are two common methods to calculate the reliability of electricity supply. It is System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI). SAIFI is directly affected by the number of

interruption times and SAIDI is directly affected by the duration of supply interruption.

Almost all CEB consumers are affected by power interruptions each and every month. 100% reliable supply cannot be assured by any of the Electricity supplier in the world. But this study is aim to identify alternate electricity feeding plan and suggest possible solutions to provide N – 1 contingency Electricity feeding plan. This will obviously improve the reliability of electricity supply. SAIDI will be measured before and after the propose solutions to analyze the improvement of reliability.

1.3 Contribution

Load readings have been collected and modeled based on the MV network of Dehiwala area using Synergee software. MV network for year 2020 is modeled using accepted growth rate. N-1 Electricity feeding arrangement has been checked for all MV lines. New MV line arrangements are proposed which N-1 feeding arrangement is not satisfied. Cost estimation is prepared for new proposals. Build common model to match the N-1 Electricity Feeding arrangement which can be applied to any distribution area.

1.4 Organization of the Thesis

Chapter 02 discusses the problem statement of the project including identification of the project and Objective of the study. Chapter 03 discusses the methodology of the project. It also includes a proposal to CEB, details of the case study, Synergee Models and validation of the Synergee models.

Finding and results are discussed in the Chapter 04. It describes the new MV line requirement to match the N-1 Electricity feeding plan. Feeder of PS or GS fails, Incoming of PS fails and PS fails are discussed separately. Availability of N-1 feeding arrangements are checked for above cases and propose new alternate arrangement if it is not available. Estimation costs for new proposals are discussed in the Chapter 04. Also SAIDI values and common models to check the N-1 feeding

plan for PS incoming feeder fails, PS fails and 33 kV / 11 kV Feeder fails are discussed in this chapter.

Finally, Chapter 05 discusses the conclusion and recommendation of the project.

Chapter 2

PROBLEM STATEMENT

2.1. Identification of Problems

At the early stage, main target of the CEB is to provide electricity for all people. Reliability is not much considered during that time. Most of the Electricity distribution lines (Feeders) are radial types. Once breakdown, all consumers at the feeder will be affected.

Only few urban areas have ring type distribution system. Fault can be isolated and unaffected consumers can be fed using 2nd circuit in those areas. Numbers of interrupted consumer are less in these areas.

2.2. Objectives of the Study

Provide N – 1 electricity feeding arrangement to all consumers once Grid Substation or Primary Substation or Feeder is out. Alternate Medium Voltage (MV) feeding arrangement should be provided for all consumers.

MV feeders include 11 kV lines and 33 kV lines. MV lines are selected to reduce the considerable amount of interrupted consumers once it is failed.

2.3. Literature Review

Electrification level is 100% and availability of contingency electricity feeding plan is very common for Developed countries. Power interruptions are rarely found with them. It is totally different at developing countries. Less Electrification level and daily schedule power cuts exists. Most of the South Asian countries are having daily power outages as their installed capacity is not enough to serve the total power requirement. Sometimes power outages extends 12 – 16 hours per days. Though Electricity is available in those countries, reliability is not assured. People who are living in those countries are lucky if electricity supply is available even though it is not reliable.

At the starting stage the main target was to provide electricity. Once electricity becomes an integral part of people's lives they demand supply reliability. There are several types of contingency electricity feeding plans. Some can be represented as N-X, where X is 1, 2 or 3. X describes number of alternate electricity feeding arrangement. There should be at least one alternate feeding arrangement to satisfy the consumers. It can be indicated N-1 and it is widely accepted in the planning and operation of the distribution systems. If more alternate electricity feeding arrangements are available it will help to provide better service to the customer.

There are several documents available for Contingency electricity feeding plan including books [09] and some were presented as papers. [03], [04], [05], [06], [07], [08] Reliability of Electricity supply is very critical point to discuss. Many studies have been done regarding the Electricity supply reliability. Measurement of supply reliability is not easy. Even though it is measured, accuracy cannot be guaranteed. It is noted that controlling the numbers of interrupted times is not easy. But duration of interrupted time can be reduced with the alternate feeding arrangement.

Jun Xiao et al. [03] discussed both Feeder and Transformer contingencies, Distribution Automation and interconnection among feeders. This paper proposes a model for calculating the Total Supply Capability (TSC) for distribution system considering both feeder and substation transformer contingencies. Existing models and methods for TSC only consider substation transformer contingencies and ignore feeder contingencies. However, the feeder contingencies occur much more frequently than substation transformer contingencies in practice. Moreover, some operation states fail the feeder contingencies N-1 verification even they pass the transformer contingencies N-1 verification. This model is designed in feeder level, which means the topology of interconnection among feeders is accurately modeled. Secondly, a supplementary model for load balancing is set up for a better load distribution solution on feeders and transformers at TSC loading. Finally, the method is tested in a test distribution system and a real partial distribution network and the results are verified by the traditional N-1 simulation.

Most of the transformers can be overloaded for a short time period. It can be considered to match N-1 feeding plan. Substation transformers could have higher efficiency if it is operated at higher loading rate. Distribution Automation will help to maintain the operated load of the Substation transformer. The distribution system N-1 security consists of two parts. One is feeder N-1 contingencies and other one is substation transformer N-1 contingencies. This paper describes N-1 security test, which need to pass all transformers and feeders. N-1 test has two steps. One is N-1 test pass for present system and other step is increase load of one feeder very small and check the N-1 test. This model considers load and N-1 security for both transformers and feeders.

Luo Fengzhang et al. [04] indicates a proper evaluation on the power supply capability of urban distribution system is of much social and economical significance. In competitive marketing environment, to satisfy the sustainable growth of distribution loads, electric utilities must judge whether the return of power supply capability is sustainable and valued against the certain amount of investment. Therefore, to make up the insufficiency of traditional methods referring from the concept of total transfer capability (TTC) of transmission system, this paper proposes a straightforward method to evaluate the power supply capability (PSC) of distribution system, which is based on N-1 contingency analysis of interconnected main-transformers.

Firstly, a series of interconnected main-transformer groups are drawn from the main-transformers interconnection analysis after the topological simplification of distribution system. Secondly, the maximum average loadability of each main-transformer is concluded through the N-1 contingency analysis of every interconnected group. Finally, based on a comprehensive analysis of all the interconnected groups results, the maximum permissible loadability of each main-transformer can be obtained, thus the PSC of the entire distribution system can be calculated. Moreover, the interconnection weak-points and the interconnection bottlenecks of the distribution system can be identified easily with this approach,

thus providing effective references for urban distribution network planning and the following project investment decisions.

J.S. Wu et al. [05] propose a methodology to solve contingency load transfer of distribution systems by applying the object-oriented expert system. By this method, the faulted area is isolated and restored and the unfaulted, but out of service, area is restored effectively. Since the fault restoration has to be performed in a short time period and the affected area has to be constrained in a small area, it has become a critical issue to enhance the system reliability for the distribution system operation. The knowledge rule base with object-oriented programming can be designed to support distribution contingency management in an effective manner. The distribution facilities are designed as a class in the database and the distribution operation rules are created to form the knowledge base. To demonstrate the effectiveness of the proposed method, one of the Taipower distribution systems is selected for computer simulation. It is concluded that the contingency load transfer of distribution systems can be solved efficiently by identifying the proper switching operation to solve the distribution contingency problem.

As it was described above, contingency electricity feeding arrangement is widely discussed in the world and really necessary for consumers. At least all Electricity service providers need to satisfied N-1 feeding arrangement for their customers satisfaction. If there are competitive electricity suppliers, consumers will more likely selected reliable service provider even though their unit cost is comparatively high.

Sri Lanka has a different situation. CEB has the monopoly to provide electricity to all over the country. CEB is not a profit making organization. CEB is providing service to consumers. Government is deciding the electricity tariff and CEB provide the service with the support of Government. Domestic consumers are receiving more concession compare to other consumers. [01]

Presently CEB has no proper contingency electricity feeding plan. Consumers are suffering and complaining about that. As CEB will reach the Electrification level up

to 100% within next one or two years, CEB needs to make a proper plan to provide alternate feeding arrangement to their consumers. Once reach the 100% Electrification level, CEB can mainly focus on reliability of electricity supply. This is really critical issue for CEB as they are the only electricity provider in Sri Lanka.

As Sri Lanka is developing country, there are many limitations to be considered while implementing new proposal. Even though it is really required, implementation may not occur due to various reasons. Therefore analyzing the new proposals should be done very carefully and suggestions need to be presented within the limitations. Cost, Construction ability, conflicts with other organizations, political interference and clearance & safety issues need to be analyzed properly before it is finalized.

Chapter 3

METHODOLOGY

3.1. Proposal for CEB

As it is discussed above, alternate feeding arrangement for Electricity distribution system is very important. At least alternate arrangement need to satisfy N – 1 feeding plan which is not available in the CEB electricity supply. Set of rules for switching operations to match the N-1 feeding plan need to be developed with the support of past experience.

It is required to use proper growth rate of electricity to be considered for load forecast. Main points to consider in the contingency feeding plan are Reliability, Availability, Construction Ability and Cost. Constructions of new lines need to be minimized as much as possible to avoid the conflicts during the implementation.

3.2. Case Study

Dehiwala distribution area is selected for case study. This study is done only for MV lines (33 kV & 11 kV) and four possible cases have been selected for the study as it is mentioned below.

1. Primary Substation Incoming fails
2. Primary Substation fails
3. 11 kV Feeder fails
4. 33 kV Feeder fails

There are one Grid Substation (GS) and three Primary Substations (PS) in Dehiwala area. Dehiwala GS capacity is 63 MVA and Kalubowila, Attidiya, Dehiwala PSs are having capacity of 20 MVA each. There are 45,000 CEB Consumer in this area.

Table 3.1 Statistic of Dehiwala Area

Month (2014)	Consumption (kWh)	Sales (Rs)	Average Unit Sales Price (Rs/Unit)
October	12,594,860.00	306,990,877.00	24.37
November	12,488,970.00	293,954,705.11	23.54
December	11,792,985.00	257,164,047.08	21.81

Source: Account Branch, Western Province South 01, CEB

3.2.1. Collect load data of Dehiwala Area

Load readings of Distribution Substations have been collected and tabulated in Appendix - A and Appendix – B. All loads reading were taken at night peak durations which is 7.00 pm to 9.00 pm

3.2.2. Synergee Models

Synergee software is used to create MV network. Collected load details have been used to create a Synergee model for year 2014. Bulk loads and distribution loads were entered separately. Also MV line type, capacity, PS type, Substation type were selected correctly using the available database of Synergee software.

General view of the completed Synergee model is shown in the Figure 3.1. View of the Kalubowila Primary Substation Area is shown in the Figure 3.2. Insertion load details of Bulk Substation and Distribution Substation are shown in Figure 3.3 and Figure 3.4 respectively.

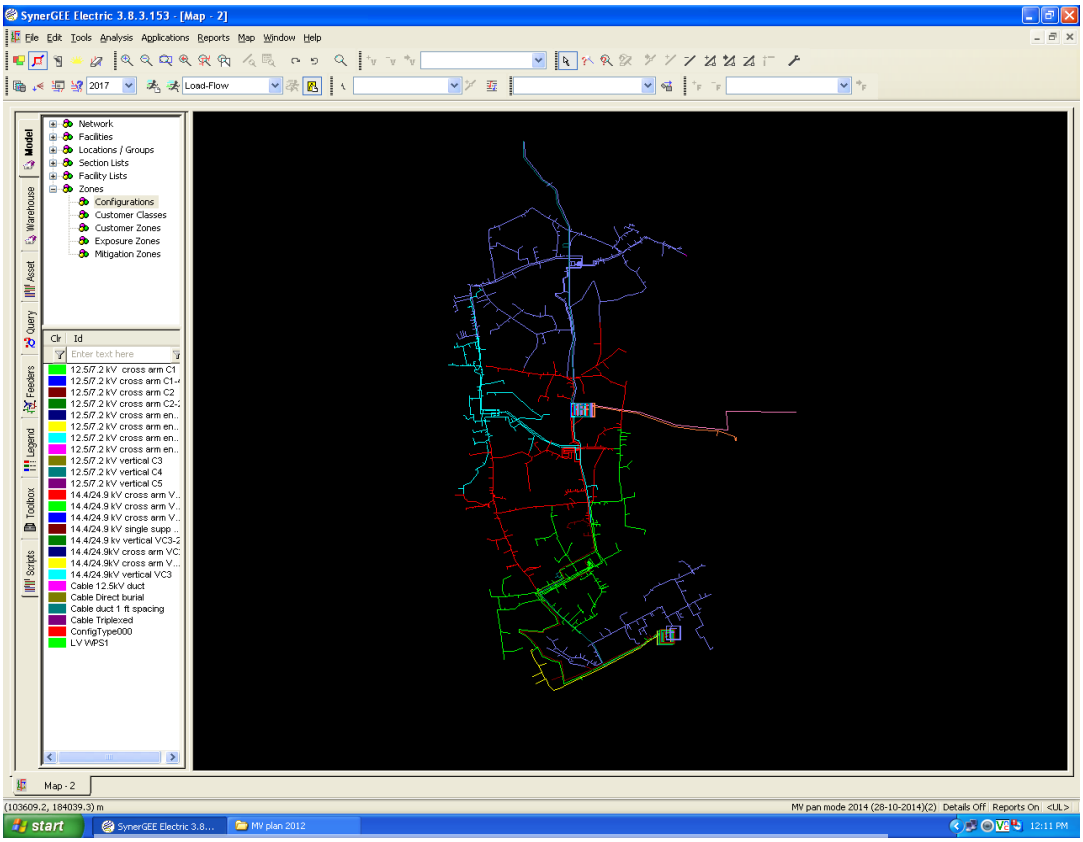

Figure 3.1: General view of SynerGEE model for year 2014

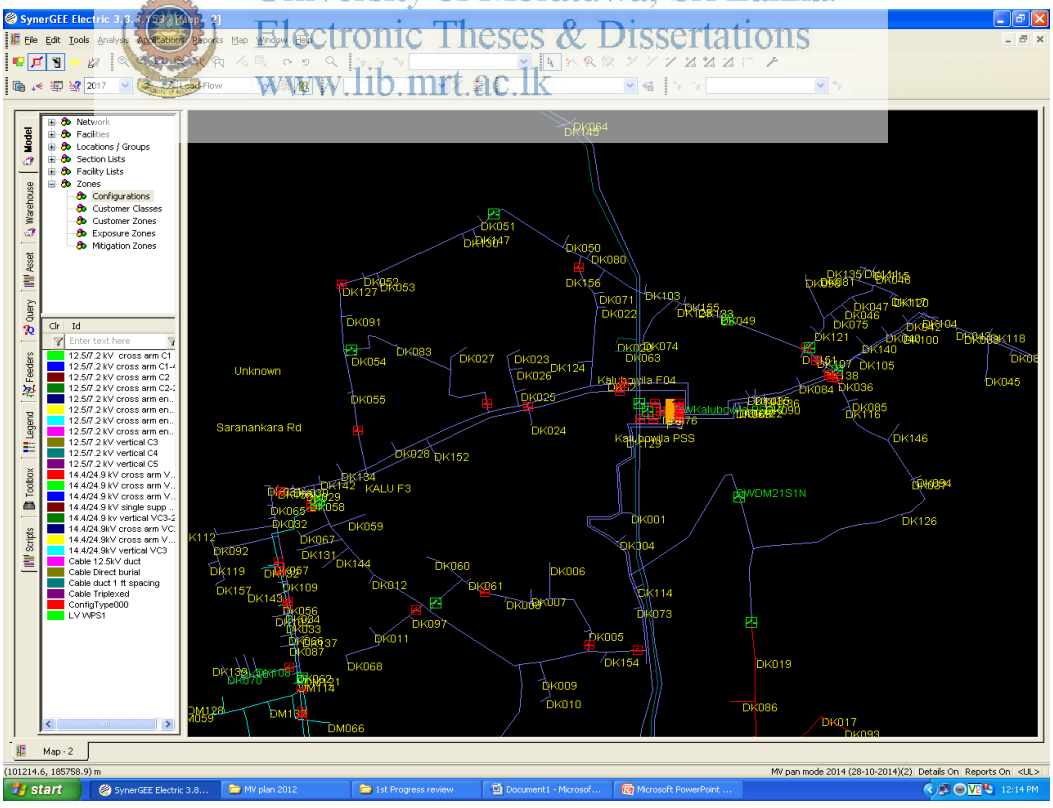

Figure 3.2: View of Kalubowila PS of SynerGEE model for year 2014

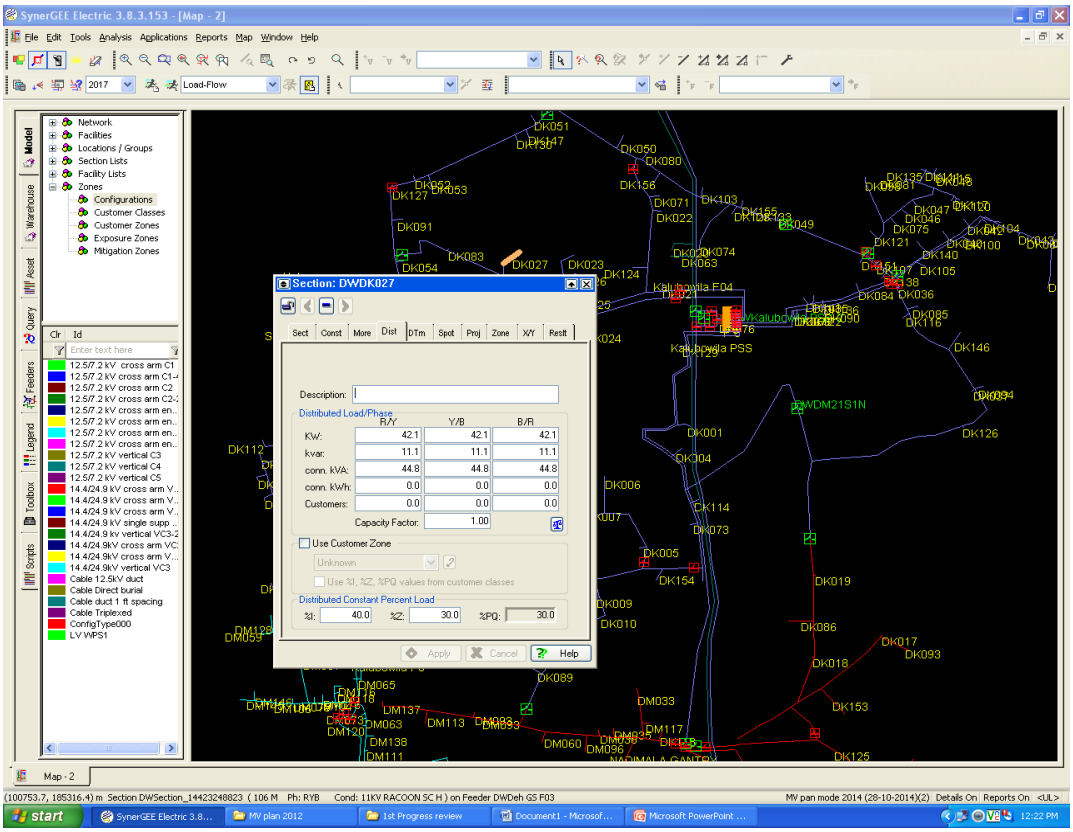

Figure 3.3: Insertion view of Distribution Load details for SynerGEE Software

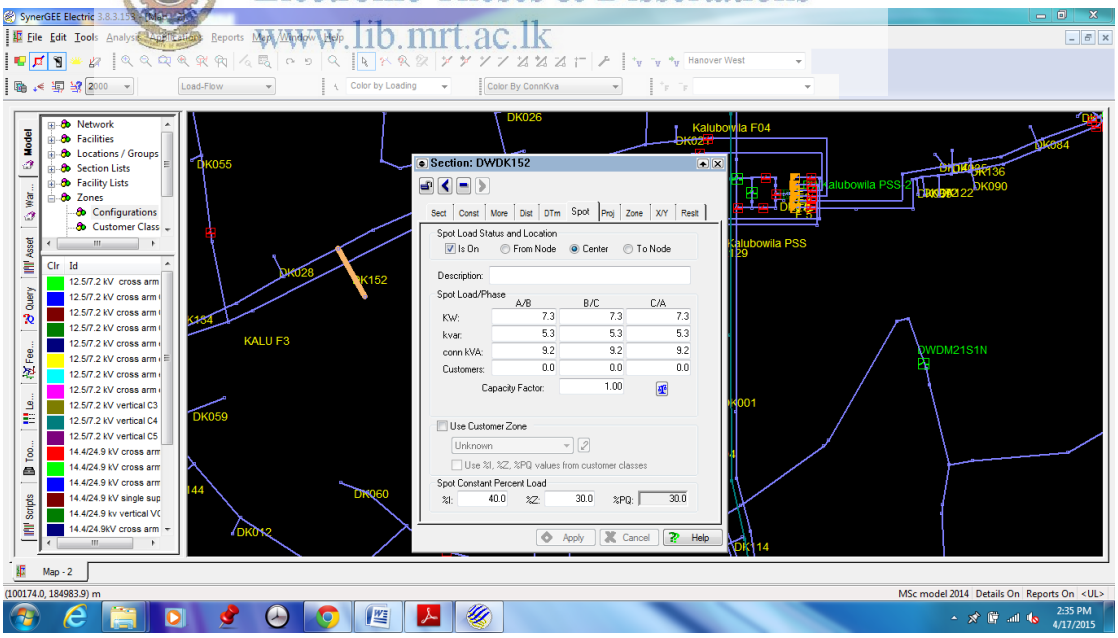

Figure 3.4: Insertion view of Bulk Load details for SynerGEE Software

3.3. SynerGEE model for year 2020

Decision was made to check the N-1 criteria for the MV model of year 2020. Time of implementation for new proposals can be justified at the year of 2020. Once entered the load details, load allocation need to be made. Date for feeder loads has been taken at 14th July 2014 to make the load allocation. Feeder details are mentioned in Table 3.2.

Table 3.2: Feeders load of GS and PSs in Dehiwala Area

Feeder	Peak Current (A)	Feeder	Peak Current (A)
Dehi GS F1	0	Dehi PS F1	90
Dehi GS F3	180	Dehi PS F2	113
Dehi GS F5	130	Dehi PS F3	12
Dehi GS F6	133	Dehi PS F4	52
Dehi GS F7	0	Dehi PS F5	103
Dehi GS F8	204		
Kalu PS F1	10	Att PS F2	177
Kalu PS F2	80	Att PS F3	135
Kalu PS F3	110	Att PS F5	118
Kalu PS F4	160	Att PS F6	108
Kalu PS F5	100		
Kalu PS F6	90		

Source: Planning & Development Branch, Western Province South 01, CEB

After load allocation is made rate of load growth is added. Load growth rate is mentioned in Table 3.3. This rate of load growth was calculated using the power consumption of last 10 years.

Table 3.3: Load Growth Rate for Dehiwala Area

	Domestic	Bulk
Growth Rate per year	2.0	5.0

Source: Planning & Development Branch, Western Province South 01, CEB

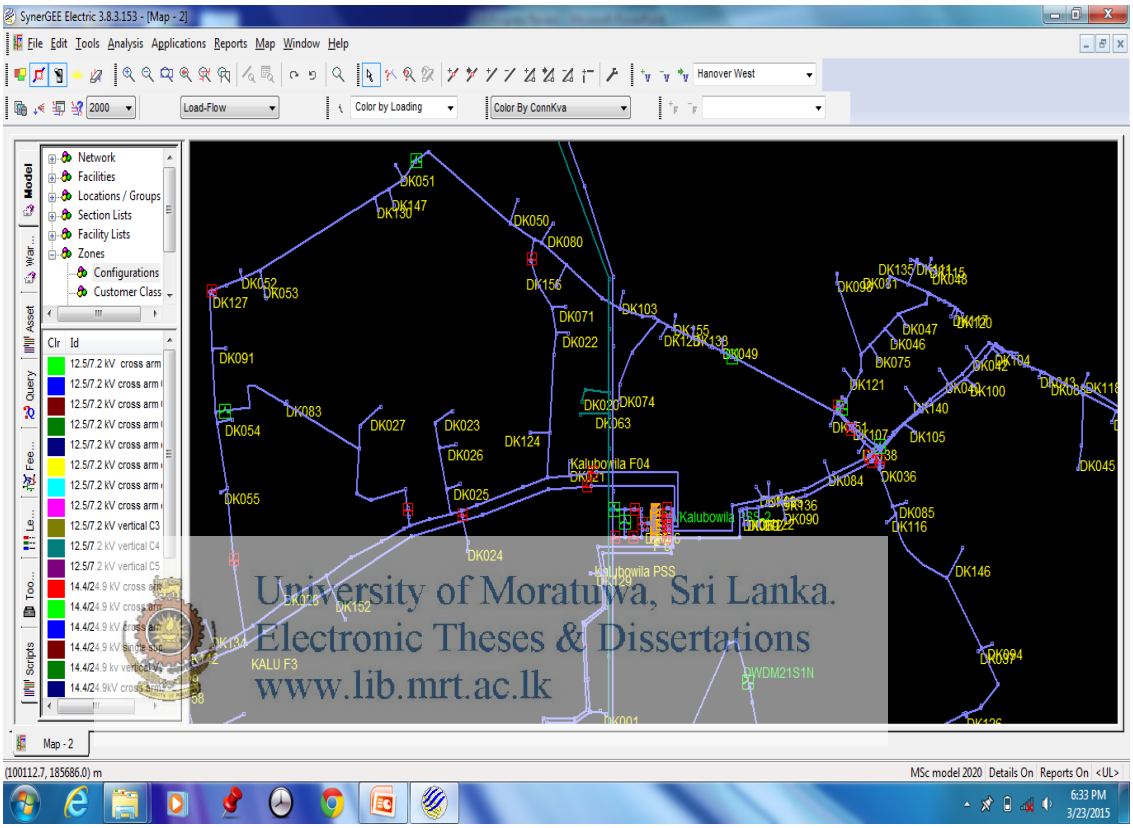

Figure 3.5: Part view of year 2020 SynerGEE model

3.4. Validation of the SynerGEE Model

Validation is required for create models. It is done using present values with the model of year 2015. Those readings are mentioned at Table 3.4. Error percentage is acceptable as per the CEB practice.

Table 3.4: Comparison of Load Values (Actual and Model of Year 2015)

GS/PS Feeder	Location	Measured Value			Output from Synergee Model 2015 (A)	Error %
		Current (A)	Date	Time		
Dehi F03 (Kalu PS F06)	Peter's lane	49	13/02/2015	19.30	45	8.1
Dehi F03 (Kalu PS F06)	Kohuwala Gantry	50	13/02/2015	20.00	45	10
Dehi F03 (Kalu PS F04)	Kohuwala Gantry	59	13/02/2015	19.45	54	8.4
Dehi F08 (Atti PS F05)	Sarananka ra Road	50	07/03/2015	20.00	47	6.0
Dehi F08 (Atti PS F05)	Lake Road	133	09/03/2015	19.50	148	11.2
Dehi F08 (Atti PS F03)	Kaudana Road	134	09/03/2015	20.00	128	4.5
Dehi F08 (Atti PS F03)	Alubogaha watta	43	13/02/2015	20.15	44	2.3

Once receive the acceptable validation values, Synergee models were created for year 2015 to 2020. Different Synergee models with the acceptable load growth rate were created for each year. Growth rates were applied separately for bulk loads and distribution loads.

4.1. New MV line requirement to match N-1 Feeding Plan

All four cases have been studied separately using Synergee model for year 2020. Some feeders satisfied the N-1 feeding plan. But most cases failed to satisfy the N-1 requirement. New MV lines, Primary Substations are difficult to construct as Dehiwala is a highly urbanize area. Free locations are rarely found as per the requirement. Considering the necessity of alternate feeding plan, new proposals have been made. Cost and construction ability are mainly considered while preparing the new proposals.

When run the load flow of Synergee model, overload lines can be seen highlighted at result window. It is shown as Figure 4.1.

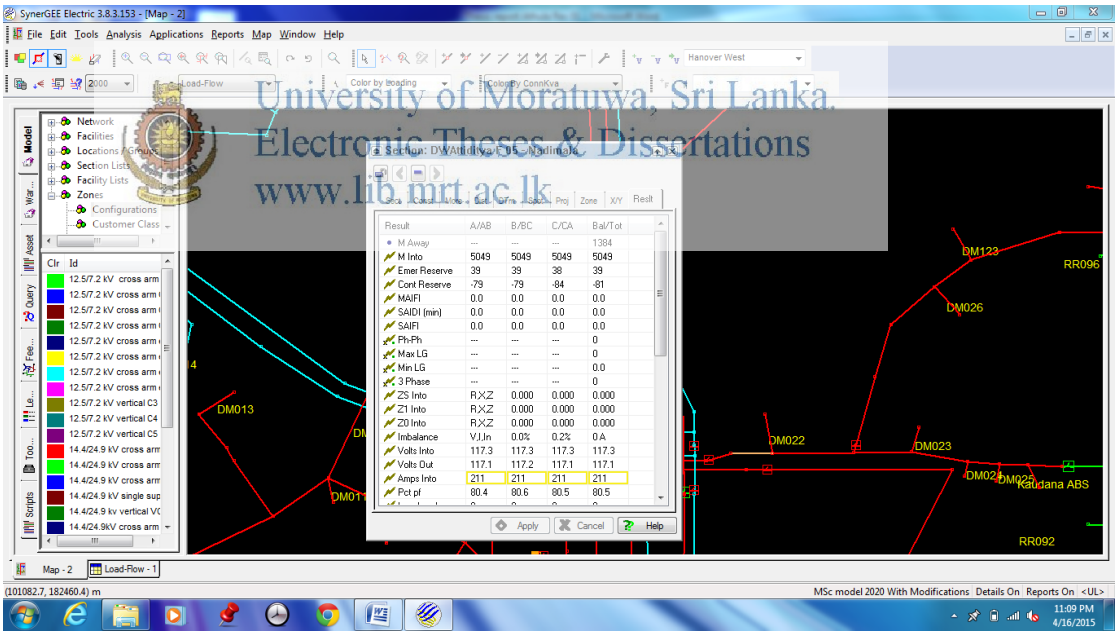

Figure 4.1: Overload lines after run the load flow

4.2. Primary Substation Fails

Capacities of the all feeders are 200A (Raccoon Line). Alternate proposals have been made to provide N-1 feeding plan which is not available at Synergee model year 2020.

4.2.1. Feeder of Kalubowila Primary Substation Fails

There are six 11 kV out going feeders connected to the Kalubowila PS. Almost all feeders are loaded with considerable amount. Synergee model of year 2020 is run while open the feeder switches at PS and extending the interconnected feeder. Then check the overload feeders. This process has been repeated for all feeders of the PS.

It is noted that there are several feeders connected to the one feeder of Kalu PS. Each and every feeder was carefully checked and proposed the best solution to match the N-1 feeding plan. There are four feeders of Kalu PS which cannot be directly extended. Once make the partially load transfer and it is possible to extend the feeder as it is mentioned in the Table 4.2. It is noted that one MV line need to be strengthened to make the partial load transfer to avoid overloading the line. Feeder details of the Kalubowila PS at SynerGEE model 2020 is mentioned in the Table 4.1

Table 4.1: Feeder details of Kalubowila PS at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Nadimala Gantry	11	Att. F6	101	Yes
F2	Council Lane	74	Dehi F1	100	Yes
			Att. F5	211	No
F3	Williams, AGA Office, LBS Pamankada	164	Dehi F5	55	No
			Kalu F4	150	No
F4	Pamankada LBS, Mudali Mawatha, Council Lane, Bathiya Mawatha	150	Kalu F6	129	No
			Kalu F3	164	No
			Kalu F2	74	No
F5	Peters Lane (Sakya), Nugegoda	77	Kalu F6	129	No
F6	Mudali Mawata, Alubogahawatta, Sakya Highlevel	129	Kalu F5	77	No

Table 4.2: Alternate proposals for Kalubowila PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F3	Dehi F5	Convert Kalu PS F6 to Lynx Circuit upto Kohuwala, Then connect Kalu PS F6 to Saranankara Bo Tree Branch Current (229 & 66+38+63). Dehi PS F5 extend up to Saranankara Bo Tree including Kalu F3(164+55-63)
F4	Kalu F2	Open De Silva Road and Closing Mudali mawatha connect Kalu PS F6 to Pamankada LBS (129+38). Then extend Kalu PS F2 to Pamankada LBS (74+150-38)
F5	Kalu F6	Kalu. F2 Kohuwala (74+64), Then Connect Kalu F6 (129-64+77)
F6	Kalu F5	Kalu. F2 Kohuwala (74+64), Then Connect Kalu F5 (77+129-64)

4.2.2. Feeder of Dehiwala Primary Substation Fails

There are five 11 kV feeders at the Dehiwala PS. Two feeders cannot be directly extended with the interconnected feeders. Once the partially load transfer is made it is possible to extend the feeder as it is mentioned in the Table 4.4. It is noted that one MV line need to be strengthened to make the partial load transfer to avoid overloading the line. Feeder details of the Dehiwala PS at SynerGEE model 2020 is mentioned in the Table 4.3

Table 4.3: Feeder details of Dehiwala PS at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Council Lane	100	Kalu F2	74	Yes
F2	RMU1 Mt. Lavinia Hotel	131	Att F3	117	No
			Att F2	97	No
F3	Urban Site LBS	7	Dehi F5	57	Yes
F4	Kawdana Board way	45	Att F2	94	Yes
F5	AGA Office	55	Kalu F3	164	No

Table 4.4: Alternate proposals for Dehiwala PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F2	Att F2	Att PS F3 extend Palm Beach Hotel Sw 1 (117+53). Then Att PS F2 extend Palm Beach hotel Sw 1 (97+131-53)
F5	Kalu F3	Kalu PS F6 Lynx Circuit to Kohuwala, Then Connect Kalu PS F6 to Saranankara Bo Tree Branch (66+38+63). Kalu PS F3 Extend Up to Dehi F5 (164+55-63)

4.2.3. Feeder of Attidiya Primary Substation Fails

There are four 11 kV feeders at the Attidiya PS. Only one feeder cannot be directly extended with the interconnected feeders. Once the partially load transfer is made it is possible to extend the feeder as it is mentioned in the Table 4.6. It is noted that one MV line need to be strengthened to make the partial load transfer to avoid overloading the line. Feeder details of the Attidiya PS at SynerGEE model 2020 is mentioned in the Table 4.5

Table 4.5: Feeder details of Attidiya PS at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F2	Suntell Galle Road, Start Hotel Road	94	Dehi F2	131	No
			Att F3	117	No
			Dehi F4	45	Yes
F3	Katukurunda, Temples Road, Suntel Galle Road	117	Rat F3	58	Yes
F5	Kawdana, Nedimala, Alubogahawatta	211	Kalu F6	129	No
			Rat F6	129	No
			Att F6	101	No
F6	Nedimala Gantry, Karagampitiya	101	Kalu F1	11	Yes
			Kalu F2	74	Yes

Table 4.6: Alternate proposals for Attidiya PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F5	Kalu F6	Kalu PS F6 Lynx Circuit to Kohuwala, Then Connect Kalu PS F6 to Nikape DDLO (129+87 & 64+87). Then Att PS F5 current is (211-87). Nedimala Gantry Dehiwala side open and feed Kalu PS F2 (74+52). Nedimala Gantry Att PS Side open and Closed Kalu PS side & Papiliyana Side and feed Att PS F5 through Kalu F1 (11+211-87)

4.3. Feeder of Grid Substation Fails

There are six 33 kV outgoing feeders connected to the Dehiwala GS. Capacities of the all feeders are 400A (Lynx Line). Synergee model of year 2020 is run while the feeder switches are open at GS and extending the interconnected feeder. Then check the overload feeders. This process has been repeated for all feeders of the GS. Alternate proposals have been made to provide N-1 feeding plan which is not available at Synergee model year 2020.

Interconnection feeders are not available for two GS feeders. New proposals are made for those two feeders and it is mentioned in the Table 4.8. Feeder details of the Dehiwala GS at SynerGEE model 2020 is mentioned in the Table 4.7

Table 4.7: Feeder details of Dehiwala GS at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Kalubowila	11	N/A	-	N/A
F3	Kalubowila	206	N/A	-	N/A
F5	Pannipitiya	0	Panni F5	36	Yes
F7	Pannipitiya	169	Panni F3	56	Yes
F6	Ratmalana	112	Rat F7	173	Yes
F8	Ratmalana	185	Rat F6	44	Yes

Table 4.8: Alternate proposals for Dehiwala GS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F1	N/A	New line to Connect to Kirulapana GS
F3	N/A	New line to Connect to Kirulapana GS

4.4. Incoming of the Primary Substation Fails

Most of the PSs are fed with two 33 kV lines. If one incoming feeder fails it can be fed from another line. It is better if two incoming feeders are from two different GSs. Then if one GS is failed, PS can be fed from other GS feeder.

PSs which have been included in the case study are fed by two GS feeders and capacities of those feeders are sufficient to feed PS without overloading the Feeders. Capacity of all incoming feeders are 400 A (Lynx line). Details of the incoming feeders of PSs are mentioned in the Table 4.9

Table 4.9: Incoming Feeder details of PSs

PS	Incoming Feeders	Peak Current (A)	Extension is possible
Kalubowila	Dehi GS F1	11	Yes
	Dehi GS F3	206	Yes
Dehiwala	Dehi GS F6	112	Yes
	Rat GS F7	173	Yes
Attidiya	Dehi GS F8	185	Yes
	Rat GS F6	44	Yes

4.5. Primary Substation Fails

One Primary Substation is connected to many consumers. When a PS fails it affects many consumers, therefore a contingency feeding plan is required for PSs. Study is conducted while all the switches at the PS and extending interconnected feeder are open. Then the overload feeders are checked and the solution is proposed for those feeders.

4.5.1. Kalubowila Primary Substation Fails

When the Kalubowila PS fails Kohuwala area cannot be fed with other interconnected lines. There is a requirement of new PS to feed that area. Feeder details of the Kalubowila PS is mentioned in the Table 4.01

4.5.2. Dehiwala Primary Substation Fails

There is one feeder which cannot be extended directly at Dehiwala PS. It can be extend using partial load transfer, observations of the load flow analysis of Dehiwala PS are mentioned in the Table 4.10 and Table 4.11

Table 4.10: Feeder details of Dehiwala Primary at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Galle Road 2nd Lane	100	Kalu F2	74	Yes
F2	RMU1 Mt. Lavinia Hotel	131	Att F3	117	No
			Att F2	97	No
F3/F5	Urban Site/AGA Office	55	Kalu F3	164	No
F4	Kawdana Board way	45	Att F2	94	Yes

Table 4.11: Alternate proposals for Dehiwala PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F2	Att F2	Att F3 extend Palm Beach Hotel Sw 1 (117+53). Then Att F2 extend Palm Beach hotel Sw 1 (117+131-53)
F3/F5	Kalu F3	Kalu F6 Lynx Circuit to Kohuwala, Then Connect Kalu F6 to Saranankara Bo Tree Branch Current (66+38+63). Kalu F3 Extend Up to Dehi F5 (164+55-63). Closed LBS at Urban Site to connect Dehi F3

4.5.3. Attidiya Primary Substation Fails

There is one feeder which cannot be extended directly at Attidiya PS. It can be extend using partial load transfer, observations of the load flow analysis of Attidiya PS are mentioned in the Table 4.12 and Table 4.13

Table 4.12: Feeder details of Attidiya Primary at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F2	Suntel Galle Road, Start Hotel Road	94	Dehi F2	131	No
			Att F3	117	No
			Dehi F4	45	Yes
F3	Katukurunda, Temples Road, Suntel Galle Road	117	Rat F3	58	Yes
F5	Kawdana, Nedimala, Alubogahawatta	211	Kalu F6	129	No
			Rat F6	129	No
			Att F6	101	No
F6	Nedimala Gantry, Karagampitiya	101	Kalu F1	11	Yes
			Kalu F2	74	Yes

Table 4.13: Alternate proposals for Attidiya PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F5	Kalu F6	Kalu PS F6 Lynx Circuit to Kohuwala. Then Connect Kalu PS F6 to Nikape DDLO (129+87 & 64+87). Then Att PS F5 current is (211-87). Nedimala Gantry Dehiwala side open and feed Kalu PS F2 (74+52). Nedimala Gantry Att PS Side open and Closed Kalu PS side & Papiliyana Side and feed Att PS F5 through Kalu F1 (11+211-87)

4.5.4. Kalubowila PS Fails (Introduce new Council lane PS)

Once the Kalubowila PS fails Kohuwala area cannot be fed with other interconnected lines. Therefore new PS is required and Kohuwala Junction is the best location for that. But there is no land available near Kohuwala area; therefore the Council lane PS is proposed to overcome the problem as there is CEB land available.

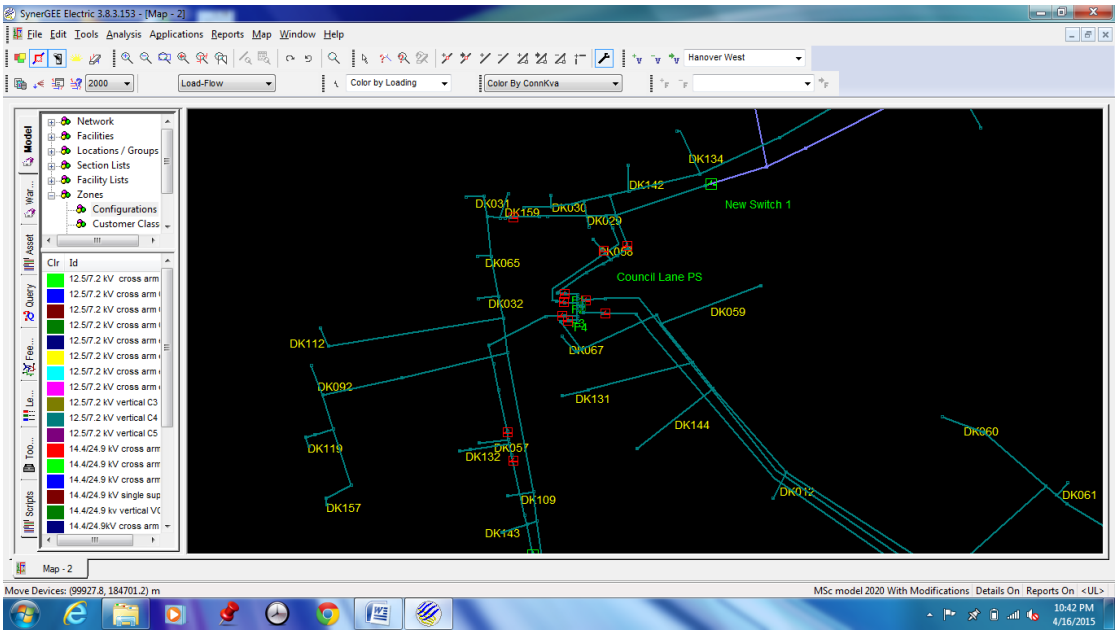

Figure 4.2: View of the Council Lane PS

There are two feeders which cannot be directly extend to the interconnect feeders. Once the partially load transfer is made, it is possible to extend the feeder as it is mentioned in the Table 4.14 and Table 4.15. It is noted that one MV line need to be strengthened to make the partial load transfer to avoid overloading the line.

Table 4.14: Feeder details of Kalubowila PS at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Nadimala Gantry	11	Att. F6	101	Yes
F2	Council Lane	14	Council F4	61	Yes
F3	Saranankara Road, LBS Pamankada	115	Council F2	49	Yes
F4	Pamankada LBS, Bathiya Mawatha	93	Council F1	98	Yes
F5	Peters Lane (Sakya), Nugegoda	77	Council F1	191	No
F6	Mudali Mawata, Alubogahawatta, Sakya Highlevel	129	Council F4	75	No

Table 4.15: Alternate proposals for Kalubowila PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F5	Council F1	Convert Raccoon line to Lynx line of Council PS F1 upto Kalubowila De Silva Lane. Total Current is 334A(Lynx line) /194A(Raccoon Line), Open LBS Kohuwala Police and Bhathiya Mawatha DDLO.
F6	Council F4	Kalu PS F2 & F6 feed by Council PS F4. Total current 139A. Council PS F1 to be extended upto LBS kohuwala Police.

4.5.5. Dehiwala PS Fails (Introduce new Council lane PS)

There is one feeder which cannot be extended directly at Dehiwala PS. It can be extend using partial load transfer, observations of the load flow analysis of Dehiwala PS are mentioned in the Table 4.16 and Table 4.17

Table 4.16: Feeder details of Dehiwala Primary at SynerGEE model 2020

Feeder	End Point	Peak Current (A)	Interconnect PS Feeders	Peak Current of Interconnect Feeder	Extension is possible
F1	Galle Road 2nd Lane	33	Council F3	25	Yes
F2	RMU1 Mt. Lavinia Hotel	131	Att F3	117	No
			Att F2	97	No
F3 & F5	Urban Site/AGA Office	55	Council F2	49	Yes
F4	Kawdana Board way	45	Att F2	94	Yes

Table 4.17: Alternate proposals for Dehiwala PS to match N-1 Criteria

Feeder	Interconnect PS Feeder	Alternate Proposals
F2	Att F2	Att F3 extend Palm Beach Hotel Sw 1 (117+53). Then Att F2 extend Palm Beach hotel Sw 1 (117+131-53)

As per the case study, there is a new PS at Council Lane to provide the N-1 feeding plan. Details of Council lane PS is mentioned in the Table 4.18

Table 4.18: Details of Council Lane PS

Feeder	End Point	Feeder Capacity (A)	Peak Current (A)
F1	New Switch 2 (After Asiri Mawatha), DDLO Bathiya Mawatha	400/200	98
F2	New Switch 1 (Before Saranankara Mawatha), LBS AGA Office	200	49
F3	RMU 2nd Lane Switch 01	200	25
F4	Karagampitiya Junc LBS, Near Kadawatha Rd LBS	200	75

There is no effect to the Attidiya PS from new Council Lane PS. Hence it is not separately mentioned here.

4.6. Cost Estimation for New Proposals

Cost estimation is really important to implement the proposals. Even though, N-1 electricity feeding arrangement is very important, funding source for estimation cost need to be found. Estimation is made using CEB Standard Construction cost 2015 [13] and the support of Planning and Development branch Region 04.

Estimated total cost is Rs. 686,678,500.00. It is a large amount as it is considered with the money value. But implementation of new proposals is necessary to improve the reliability of Electricity supply at Dehiwala Area.

Estimate details are separately mentioned in the Table 4.19

Table 4.19: Estimate cost for new proposals

S.No.	Description	Qty	Rate (Rs.)	Cost (Rs.)
1	Convert Raccoon to Lynx Kalu F6 up to Kohuwala Gantry	1.5 km	4,043,000.00	6,064,500.00
2	Council lane Primary, 10 MVA X 2 PSS 33kV/11kV and 400 A LBS 11 kV X 4 nos (4 feeders including Switchgear)	1 No	530,000,000.00	530,000,000.00
3	1.5 km Double Circuit of 33 kV line (Council Lane PS Incoming)	1.5 km	8,253,000.00	12,379,500.00
4	400 A LBS 33 kV (Council Lane PS Incoming)	4 Nos	1,151,000.00	4,604,000.00
5	New 400 A LBS 11 kV X 2 nos at Kalu F3 & F4	2 Nos	783,000.00	1,566,000.00
6	Dehi GS F1 & F3 Connection to Kiru GS (Under Ground)	1.5 km X 2	42,000,000.00	126,000,000.00
7	Convert Raccoon to Lynx Council PS F1 to Kalubowila De Silva Lane	1.5 km	4,043,000.00	6,064,500.00
	Total			686,678,500.00

Source: CEB Standard Construction Costs 2015 dated 2015/02/16 Circular No. 2015/DDC/COM-2, Planning and Development division, Region 04, CEB

4.7. Calculation of SAIDI

SAIDI [11] and SAIFI [12] are the well-known index for analyzing reliability of the power supply. SAIDI is directly related to the project. SAIDI can be calculated using equation (01)

$$\text{SAIDI} = \frac{Sum\ of\ all\ consumer\ interruption\ durations}{Total\ number\ of\ consumers\ served} \quad (01)$$

$$= \frac{\sum U_i N_i}{N_T}$$

Where N_i - Number of Consumers,

U_i - Outage time for location i

N_T - Total number of consumer served

SAIDI value is calculated before and after the new proposals for 3 months. It is clearly visible that SAIDI has improved considerably with the new proposals. Details of the interruptions and breakdowns for SAIDI calculation were obtained from Call Centre, Western Province South 01, CEB. Details and the calculation is tabulated as Appendix – C, Appendix – D, Appendix – E and Appendix – F. Summary of the SAIDI values are mentioned at the Table 4.20 and Graphical representation of the SAIDI values present and after alternate proposals are mentioned in the Figure 4.3

Table 4.20: Summary of SAIDI

Month		**November 2014**	**December 2014**	**January 2015**
SAIDI Value (Mins/Consumer)	Present	394	61	218
	After Alternate Feeding plan	341	54	129
	Percentage of improvement	**13.45%**	**11.48%**	**40.83%**

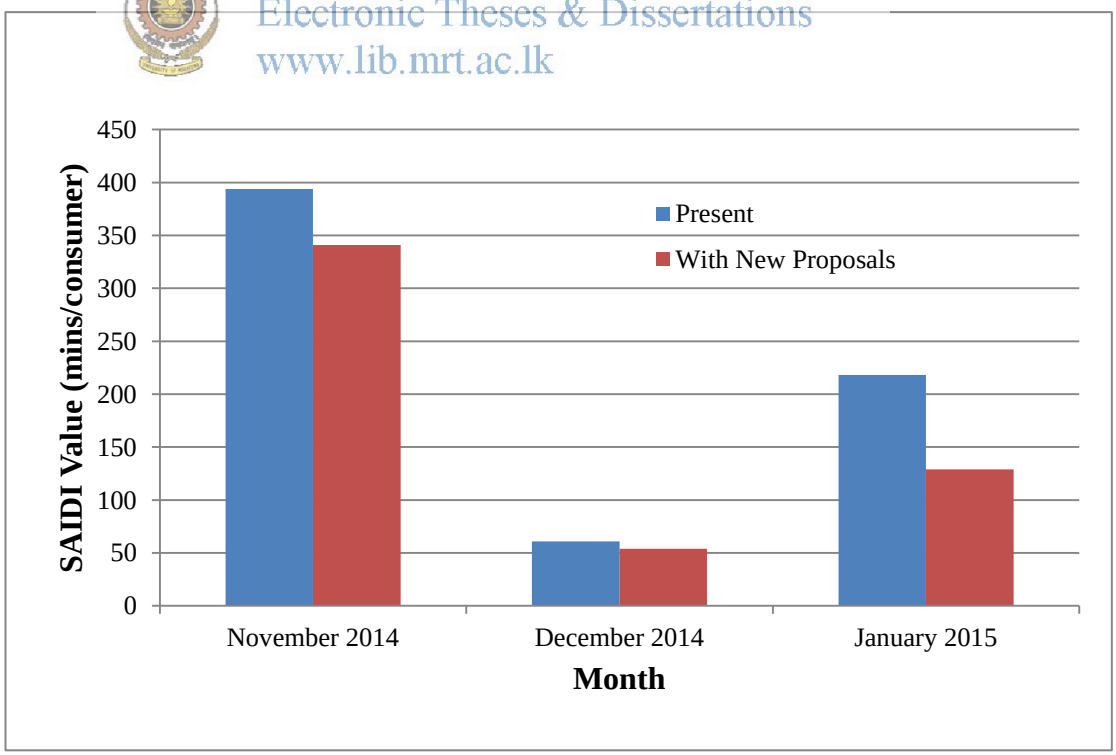

Figure 4.3: Graphical representation of the SAIDI Values

Basically less than 10 mins interruptions are not considered for improvement of SAIDI as it will take similar time for switch operations. Also reduction of consumer interruption mins were calculated for 10 mins less than the total interrupted time. It is reserved for line preparation work and switching operations.

When considered month of November 2014, reduction of consumer interruption mins were calculated using the new proposals at Kalubowils PS F3, F5, F6 and Dehiwala PS F5. Total interrupted mins of Dehiwala area for month November 2014 is 17,765,717. Total mins of savings is 2,369,139. Calculations are mentioned in Appendix - D

December 2014, reduction of interrupted mins were calculated using new proposals at Kalubowila PS F3, F5 and F6. Total interrupted mins of Dehiwala area for the month of December 2014 is 2,748,926. Total mins of savings is 324,170. Calculations are mentioned in Appendix - E

January 2015, reduction of interrupted mins were calculated using new proposals at Kalubowila PS F3, F4, F5 and F6. Total interrupted mins of Dehiwala area for January 2015 is 9,842,202. Total mins of savings is 3,982,902. Improve percentage of SAIDI is high in January 2015 compare to other months due to new proposals are effected long durations of the interruptions. Calculations are mentioned in Appendix - F

4.8. Common Models for N-1 Feeding plan

Case study has been conducted to initiate and analyze the result of the project proposal. Considering findings and results of the case study common models have been developed to match the N-1 feeding plan, which can be applied to any of distribution region. Three separate models have been developed for three different cases.

4.8.1. Primary Substation Incoming Feeder Fails

Incoming feeders of the PSs are connected to GS. When the incoming feeder fails the PS will be dead if there are no alternate incoming feeders. This will affect lot of consumers. Once incoming feeder of PS fails, follow the procedure which is mentioned below.

1. Check the availability of alternate incoming feeders
2. If available check the remaining capacity
3. Then check the capacity and make the feeder transfer
4. If required capacity is not available, make the partial load transfer to other feeders to match the required capacity.
5. After that if it is not available, strength the line and try to source the required capacity.
6. Once required capacity is available, make the feeder transfer.
7. If all above methods fails, build a new 33 kV or 11 kV MV lines as per the requirement.

Once it is decided to build new MV lines, it must be carefully analyzed considering cost, construction ability and availability. It is required to avoid new lines as much as possible while matching the feeding plan using existing network.

Develop model for this situation is mentioned at Figure 4.4.

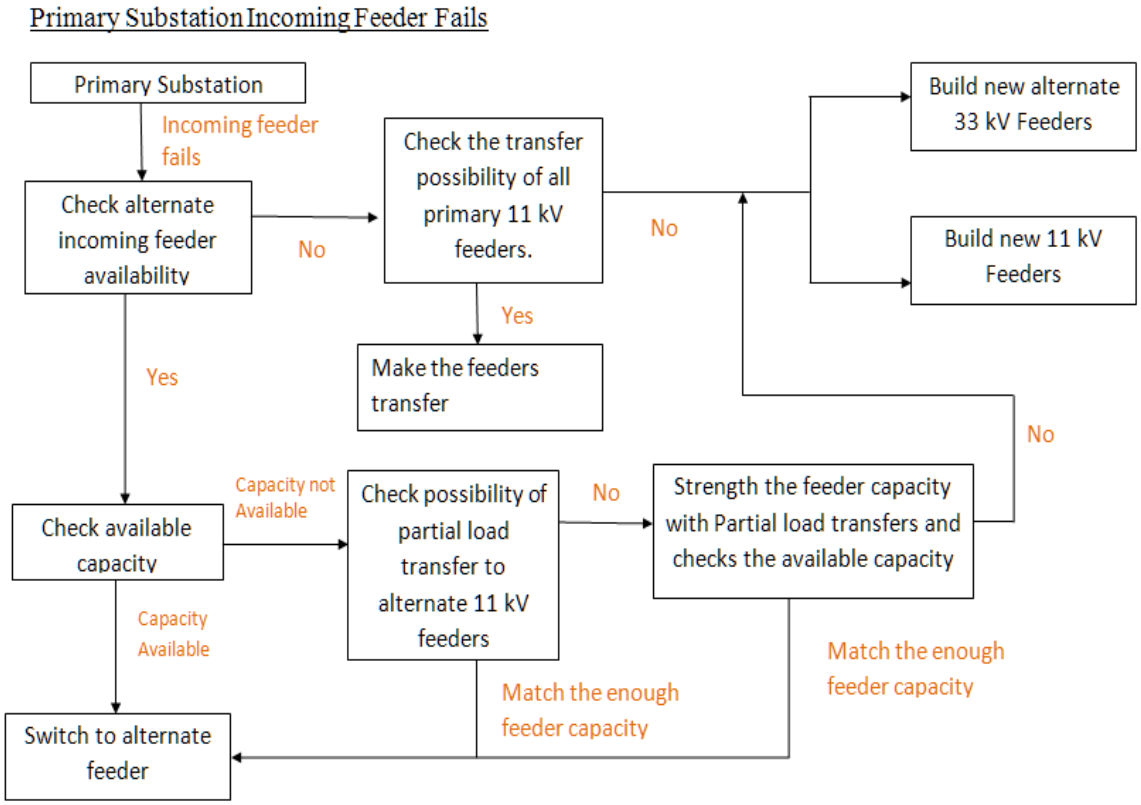

Figure 4.4: Develop Model for PS Incoming Feeder Fails

4.8.2. Primary Substation Fails

When the PS fails, all connected consumers are affected. Therefore numbers of interrupted people are high. N-1 feeding plan will be help to reduce the number of interrupted consumers. Once PS is dead, check the availability of alternate interconnects feeders. If it is available, then check possibility of transfer all the feeders to interconnect feeders. If it is not possible make the partial load transfer and strengthen the lines to make the load transfer. If all above fails, build new 11 kV lines as appropriate.

Develop model for this situation is mentioned in Figure 4.5.

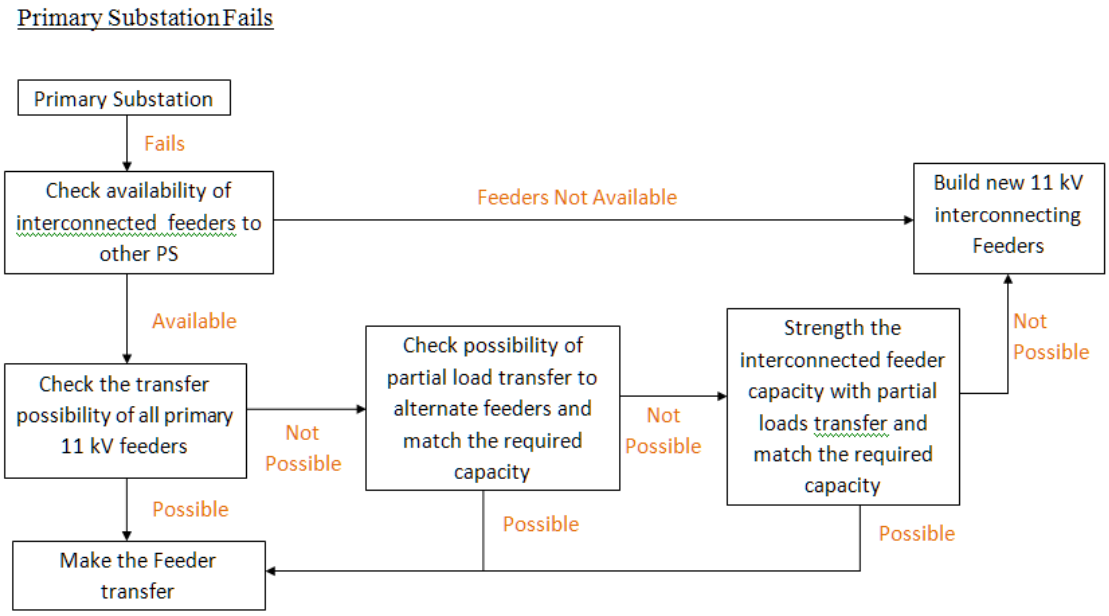

Figure 4.5: Develop Model for Primary Substation Fails

4.8.3. 33 kV / 11 kV Feeder Fails

N-1 feeding plan will help to reduce the interrupted consumers once MV feeder fails. Develop model for this situation is mentioned at Figure 4.6.

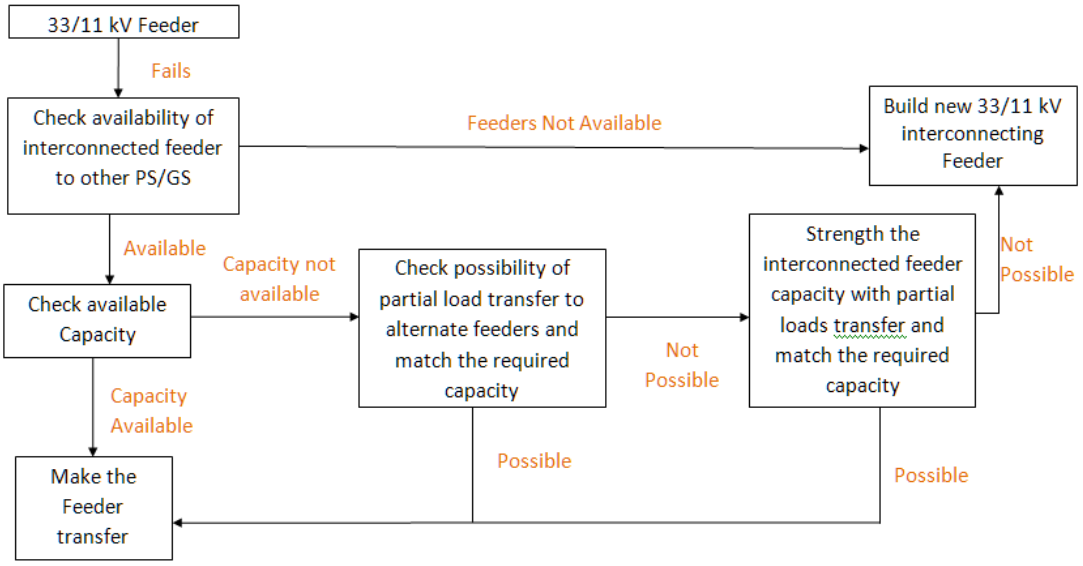

Figure 4.6: Develop Model for MV Feeder Fails

Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The objective of this study is to increase the reliability of CEB power supply providing N-1 Electricity feeding plan. Few years back, target of the CEB was to achieve the 100% electrification level and reliability of the electricity supply was not much of a concern.

Reliability of electricity supply can be increased using N-1, N-2, N-3 electricity feeding plan. Aim of this study is to initiate N-1 electricity feeding plan for distribution area of the CEB. Case study is done to observe the present system and check the possibility of improvement.

Requirement of new proposals to match N-1 electricity feeding plan in Dehiwala area are examined and validated using year 2020 Synergee model as per the Table 4.1 to Table 4.17. Costs for new proposals are estimated to get an idea about fund requirement. Estimation cost is mentioned in the Table 4.19

Reliability of the electricity supply can be analyzed using SAIDI and SAIFI. SAIDI is directly related to this project. Summary of calculated SAIDI values for three months are mentioned in the Table 4.20.

When comparing the SAIDI values with the present system and proposed system, it is clearly shown that considerable amount of improvement of the SAIDI at proposed system as it is shown in the Table 4.20. Therefore CEB need to provide at least N-1 electricity feeding arrangement to all consumers to help to achieve their quality of life. This will help to enhance the CEB reputation within their consumers.

Three common models have been prepared to provide N-1 feeding arrangement to any distribution area using the results of case study. Three models are mentioned in Figure 4.4, Figure 4.5 and Figure 4.6

5.2. Recommendations

CEB is not a profit making organization. CEB's responsibility is to provide best service to customers with the support of Government. It is obvious that the reliability of CEB electricity supply can be improved considerably.

Kohuwala and Kalubowila are highly urbanize areas. 90% of people are receiving electricity from Kalubowila PS. If it is failed most of those people are affected and no other alternate feeding arrangement for them. There are some other similar cases have been identified at the Dehiwala area. Therefore it is recommended to implement new proposals to obtain N-1 feeding plan for Dehiwala area.

Also it is recommended to study and obtain new proposals to provide N-1 electricity feeding plan to consumers at all over Sri Lanka. This will help consumers to have comfortable life and it will help to enhance the reputation of CEB.

Reference list:

[01] Statistical Digest 2013, Ceylon Electricity Board

[02] Annual Report 2013 – LECO

[03] Jun Xiao, Xin Li, Wenzhuo Gu, Fangxing Li, Chengshan Wanga, *"Model of distribution system total supply capability considering feeder and substation transformer contingencies",* Electrical Power and Energy Systems 65 (2015) 419–424

[04] Luo Fengzhang, Wang Chengshan, Xiao Jun, Ge Shaoyun, *"Rapid evaluation method for power supply capability of urban distribution system based on N-1 contingency analysis of main-transformers",* Electrical Power and Energy Systems 32 (2010) 1063–1068

[05] J.S. Wu, T.E. Lee, Y.M. Tzeng, C.S. Chen, *"Enhancement of an object-oriented expert system for contingency load transfer of distribution systems",* Electric Power Systems Research 42 (1997) 87-94

[06] Jaeseok Choi, Timothy Mount and Robert Thomas "*Transmission System Expansion Plans in View Point of Deterministic, Probabilistic and Security Reliability Criteria*", Proceedings of the 39th Hawaii International Conference on System Sciences – 2006

[07] Mendes A., Boland N., Guiney P., Riveros C., *"(N-1) contingency planning in radial distribution networks using genetic algorithms"* Transmission and Distribution Conference and Exposition: Latin America (T&D-LA), 2010 IEEE/PES 290-297

[08] Jun Xiao, Guo-qiang Zu, Xiao-xu Gong, and Cheng-shan Wang "*Model and Topological Characteristics of Power Distribution System Security Region"* Hindawi Publishing Corporation Journal of Applied Mathematics (2014) Article ID 327078

[09] H. Lee Willis, "*Power Distribution Planning Reference Book, Second Edition, Revised and Expanded*" 499-502

[10] www.ceb.lk

[11] http://en.wikipedia.org/wiki/SAIDI

[12] http://en.wikipedia.org/wiki/SAIFI

[13] CEB Standard Construction Costs 2015 dated 2015/02/16 Circular No. 2015/DDC/COM-2

[Appendix – A]

Load Reading of Dehiwala CSC					
SIN	**S/S Name**	**11 kV S/S Capacity (KVA)**	**Type**	**Date of Load Reading**	**Peak Load (KVA)**
DM001	Miyami New light (Kundanmals Apperal)	500	B	2014.01.21	4.3
DM002	Ladies Diamond	500	B	2014.01.29	41.0
DM003	Deeky Factory	630	B	2013.09.04	8.3
DM004	Dee Jay Factory	250	B	2014.01.21	0.4
DM005	H & T	100	B	2013.09.04	3.8
DM006	Letherate Cey.Ltd(Removed)				-
DM007	Removed				-
DM008	Removed				-
DM009	Badowita II	100	D	2013.09.09	23.4
DM010	Badowita 1	630	D	2013.09.11	233.2
DM011	Sirisangabo Abesekara Rd)	250	D	2013.09.05	182.1
DM012	Huluda goda	400	D	2013.09.11	212.6
DM013	Kawdana Broadway	250	D	2013.09.05	178.6
DM014	Consolidated	100	B	2014.01.24	55.7
DM015	Peris Road	250	D	2013.09.26	227.6
DM016	Shantha Road	250	D	2013.10.09	158.0
DM017	Pallyadora	250	D	2013.10.09	116.0
DM018	Land Development	160	D	2013.09.24	71.1
DM019	Parakum Mawatha	250	D	2014.01.07	178.9
DM020	De Soysa Road	250	D	2013.09.04	130.6
DM021	Templers Rd	500	D	2013.09.10	157.5
DM022	Ceylinco Homs	100	D	2013.09.10	36.7
DM023	Lake Cresent	160	D	2014.01.07	64.5
DM024	Sumththra Weaving	160	D	2013.09.23	63.4
DM025	M.G.Industries	250	B	2014.01.13	4.7
DM026	Keels Cresnet	160	D	2013.09.02	52.9
DM027	Lotus Grove	400	D	2013.09.09	75.8
DM028	Land Red Development	160	D	2013.09.05	47.5
DM029	Paradigama Clathing (No: 107 , Pallidor Rd)	1000	B	2014.02.25	133.4
DM030	Nagindas	630	B	2014.01.29	0.5
DM031	Winterquilts (No 111 Pallidora Rd, Dehiwala)	1000	B	2014.01.24	48.7
DM032	Sinwa	400	B	2013.10.30	100.5
DM033	Quarry Rd	250	D	2013.10.09	186.4
DM034	Siriwardana Rd	250	D	2013.09.24	171.4
DM035	Mins Consumer	250	D	2013.10.28	173.6
DM036	Mins Factory CBA	500	B	2013.10.20	135.5
DM037	Hotel Rd No1	630	D	2013.09.30	144.9

DM038	Telecom (Disconnected)	250	B		-
DM039	De Seram Rd	630	D	2013.09.30	65.0
DM040	Keels Sub	500	B	2014.01.16	150.0
DM041	De Seram Road	250	D	2013.10.07	208.2
DM042	Cross rd	400	D	2013.10.07	358.2
DM043	Mt lavinaia Bus Stand	800	B	2013.10.07	104.2
DM044	Super marked(removed)				-
DM045	Ozenic Blick	250	B	2014.01.20	25.2
DM046	Vihara Mw	250	D	2013.09.25	111.5
DM047	De Alwis Palce	400	D	2013.09.11	175.8
DM048	Chadilace Garments	160	B	2014.01.23	8.6
DM049	Hotel Rd	250	D	2013.09.23	196.7
DM050	Hotel Rd	630	B	2014.01.16	454.7
DM051	Palm Beach Hotel	1000	B	2014.01.16	752.3
DM052	Disconnected				-
DM053	(Kanaththa S/S Mt.Lavinia)	500	D	2013.10.10	11.5
DM054	Dadly Senanayake Mw	400	D	2013.10.25	4.9
DM055	Osmanside(Old)	250	D	2013.10.25	47.7
DM056	Pump House Dharmapala Mw	100	B	2014.01.22	4.5
DM057	Mt. Lavinia coat	630	D	2013.10.10	43.1
DM058	Mt Royal Hotel	250	B	2014.01.30	121.9
DM059	Mt.Royal Hotel	400	B	2014.01.30	10.1
DM060	Police Station	400	D	2014.02.27	262
DM061	Betterns	400	D	2014.02.27	162.15
DM062	Apsara	250	D	2013.10.11	51.75
DM063	Arrujina	250	D	2013.10.11	146.28
DM064	Big Apple	250	D	2013.10.11	45.1
DM065	YMBA - Dehiwala	400	D	2014.01.10	49.1
DM066	Malwatte Road	400	D	2013.10.11	15.6
DM067	Fair Line Rd	630	D	2014.01.08	129.0
DM068	Dehiwala Primary	160	D	2014.01.08	3.22
DM069	Attidiya primary	160	D	2014.01.08	5.06
DM070	Tilly Hotel (Removed)	400			-
DM071	Gilley Hotel	250	B	2013.10.07	53.2
DM072	Asian Cotton (Removed)				-
DM073	Bata	250	B	2014.01.24	18.0
DM074	No:84, Kawdana, Attidiya.	160	B	2014.01.13	17.6
DM075	Dehiwala station	400	D	2014.01.13	115.46
DM076	Dehiwala Juntion	400	D	2014.01.23	44.85
DM077	Singer Mega	160	B	2014.01.23	42.1
DM078	Kalapura	160	D	2013.09.04	187.5
DM079	Jinadasa Apperals	160	B	2014.01.22	5.5
DM080	HNB (MT Lavinai)	160	B	2014.01.22	5.5
DM081	Palliyadora (new)	160	D	2013.09.24	68.4
DM082	Disconnected	250	D		-

DM083	De Serum Rd	250	D	2013.09.10	122.85
DM084	De Seram Road	250	D	2013.09.10	114.4
DM085	Templer Road	250	D	2013.9.26	157.8
DM086	Kawdana (Pokuna)	250	D	2013.09.10	38.0
DM087	Templers road (new)	250	D	2013.09.11	58.2
DM088	Huludagoda (new)	250	D	2013.9.5	366.3
DM089	Subodarama Sub	160	D	2013.09.26	122.2
DM090	KDT.Siriwardana Family Super	250	B	2014.01.22	256.1
DM091	Arpico	400	B	2013.02.21	236.9
DM092	Goevge Steuart	400	B	2014.01.21	55.7
DM093	Sudarshanaramaya	160	D	2013.10.28	239.0
DM094	No:177 C,Galle Rd.	160	B	2014.01.09	72.9
DM095	Gunadasa	250	B	2014.01.09	53.6
DM096	Gunadasa & Co.	160	B	2014.01.20	89.8
DM097	DM Chandrasena	630	B	2014.01.20	328.5
DM098	Removed				-
DM099	Deta Research (Removed)	100	B	2014.01.20	144.2
DM100	Removed				-
DM101	Housing Sckeem	100	D	2013.09.04	65.2
DM102	Apatrtment Mt.Lavinia	100	D	2013.09.10	8.7
DM103	Apartment - Mt.Lavinia	400	B	2014.02.05	60.1
DM104	Harcourts	250	B	2014.02.18	29.0
DM105	Oman Place (new)	250	D	2013.10.25	24.6
DM106	LTP Property Developers	160	B	2013.10.25	6.1
DM107	Marmimta Dev (Removed)				-
DM108	Magnum Garments	630	B	2014.01.17	159.8
DM109	Siripala Road Apartments	250	D	2014.02.06	10.8
DM110	Aponsu Rd Apartments	100	D	2013.10.25	22.7
DM111	Five Star London	100	B	2014.01.20	9.4
DM112	St Thomas	250	B	2014.01.20	235.0
DM113	Hill Regency(Bulk)	250	B	2013.10.28	1.6
DM114	Fashion Park	160	B	2014.01.24	71.0
DM115	Juwelsco Restaurant	160	B	2014.01.22	40.9
DM116	G D I Fashion World	630	B	2014.01.30	24.5
DM117	Sheraton Ins.	400	B	2013.10.20	8.6
DM118	Lanka Bible Colege	100	B	2014.01.30	9.9
DM119	FAB Mt. Lavinia	100	B	2014.02.06	32.9
DM120	Fashion Bug Dehiwala	250	B	2014.02.18	8.1
DM121	Sampath Bank MtLavinia	630	B	2014.11.27	69.5
DM122	Lanka Telecom Mt. Lavinia	630	B	2014.01.06	258.9
DM123	Ceylinco Homes Attidiya	100	B	2013.09.02	0.2
DM124	Keels, Temples Road	160	B	2014.01.29	34.4
DM125	Land Rec. Development	160	B	2013.09.02	0.23
DM126	Mt.Lavinia Hotel	1000	B	2014.01.16	587.4
DM127	Elephont Cout	100	D	2014.02.06	8.5
DM128	Inner Fairline Rd	160	D	2014.01.30	21.0

DM129	Good Hope Property	160	D	2013.09.23	16.0
DM130	No 30,Station Rd,Mt.Lavinia	160	D	2013.09.23	4.4
DM131	No 47,Pristige Court Residence	100	D	2014.02.11	3.2
DM132	Near AGM Office	100	D	2014.01.10	2.1
DM133	Mt lavinia Beach Junction	100	D	2013.10.07	3.0
DM134	Kesel Kotuwa Junction	250	D	2014.01.20	148.1
DM135	No:18, Nolimit Kawdana	160	D	2014.01.04	31.6
DM136	Kawdana New	250	D	2013.09.26	73.3
DM137	Hill Street Junction	250	D	2014.10.11	12.4
DM138	Dehiwala Old Market	250	D	2014.01.16	83.26
DM139	ODEL Mt Lavinia	100	D	2014.01.16	96.2
DM140	Dharmapala Mw New	250	D	2013.10.10	45.7
DM141	Cementry Mt lavinia New	250	D	2013.10.10	28.4
DM142	Nationtrus Bank(269 Galle Rd, Mt. Lavinia)	250	D	2014.02.11	8.5
DM143	Kusum Niwasa-Badovita III	100	D	2014.02.11	17.7
DM143	Kusum Niwasa-Badovita III	100	D	2013.09.09	19.4
DM144	164,Gall Rd Mt Lavinia junc	160	D+B	2013.09.09	30.82
DM145	L.H.Piyasena	800	D+B	2014.01.23	26.8
DM146	L.H. Piyasena	800	B	2014.01.23	5.8
DM147	No:12, Nolimit Kawdana (BULK)	160	B	2014.09.09	13.0

[Appendix – B]

Load Reading of Kalubowila CSC					
SIN	**S/S Name**	**11 kV S/S Capacity (KVA)**	**Type**	**Date of Load Reading**	**Peak Load (KVA)**
DK001	Peiris Rd	250	D	2013.08.05	117.30
DK002	Kadawatha Rd III	250	D	2013.08.05	120.23
DK003	Kadawatha Rd II	400	D	2013.08.05	46.92
DK004	Kadawatha Rd I	250	D	2013.08.05	91.39
DK005	Quarry Rd New Sub III	250	D	2013.08.05	139.31
DK006	Prathibimbarama Rd	400	D	2013.08.06	218.23
DK007	Quarry Cooper	160	D	2013.08.06	32.94
DK008	Zoo	250	B	2013.08.06	63.05
DK009	Athapaththu Rd	400	D	2013.08.13	150.37
DK010	Water Works	630	B	2013.08.13	139.70
DK011	Waidya Road	400	D	2013.08.13	139.89
DK012	Allen Ave.II	250	D	2013.08.13	46.07
DK013	Nedimala	250	D	2013.08.15	122.37
DK014	Nikape Rd	400	D	2013.08.15	113.61
DK015	Disanayaka Rd	250	D	2013.08.15	47.98
DK016	Bellantara Sub	400	D	2013.08.15	164.70
DK017	Saimal Mw Sub	400	D	2013.08.21	157.09
DK018	Anderson Temple	250	D	2013.08.21	119.47
DK019	Alubogaha watte	250	D	2013.08.21	167.78
DK020	Kalubowila Hospital	630	B	2013.08.21	288.11
DK021	Temple Road	250	D	2013.08.22	182.78
DK022	De Silva	250	D	2013.08.22	101.84
DK023	Charls Apartment	250	D	2013.08.22	48.90
DK024	Asiri Mw	400	D	2013.08.22	283.13
DK025	Hospital Road	400	D	2013.08.23	183.61
DK026	Keels Sub	630	D	2013.08.22	14.87
DK027	Sri Maha Vihara	250	D	2013.08.23	134.41
DK028	Wimalasiri Road	400	D	2013.08.23	316.23
DK029	Wikies Sub	250	D	2013.08.26	121.62
DK030	American Collage	160	B	2013.08.26	2.33
DK031	CSD Auto	630	D	2013.08.26	99.99
DK032	Ebanizer	400	D	2013.08.26	134.71
DK033	Galle Road 104	250	D	2013.08.27	8.51
DK034	Vandervet	250	D	2013.08.27	82.95
DK035	Mudali Mawatha	250	D	2013.08.27	125.96
DK036	Kohuwala Junction	630	D	2013.08.27	75.51
DK037	Sunethradevi Sub	250	D	2013.08.28	182.32
DK038	Woodland Ave.	250	D	2013.08.28	96.67
DK039	Mangala Mawatha	400	D	2013.08.28	166.79

DK040	Malwatte Road	400	D	2013.08.28	209.83
DK041	Removed			2013.08.29	-
DK042	Universal	400	D	2013.08.29	142.86
DK043	Nugegoda Town (Shifted) -Telecom	630	D	2013.08.29	100.89
DK044	Hilevel Rd (Removed)	630			
DK045	Ananda Road	250	D	2013.08.29	112.44
DK046	Water Loo Junction	400	D	2013.09.02	103.44
DK047	Remond Road	630	D	2013.09.02	178.82
DK048	Sausiri	400	B	2013.09.02	24.91
DK049	Thisara Sub	630	B	2013.09.02	238.14
DK050	Shinyo En.Lanka	160	B	2013.09.24	121.77
DK051	Pamankada	400	D	2013.09.24	260.34
DK052	Saranankara Road/ Temple	250	D	2013.09.24	149.6
DK053	Carawan Bekary Sub	250	D	2013.09.24	47.79
DK054	Saranankara Road III	250	D	2013.09.26	157.73
DK055	Saranankara Rd Police S/s	250	D	2013.09.26	93.48
DK056	2nd Lane sub Galle Rd	500	D	2013.09.26	215.69
DK057	Initiem Sub	630	D	2013.09.26	158.68
DK058	Council Sub	630	D	2013.09.27	257.10
DK059	Willims Sub	630	B	2013.09.27	0.00
DK060	Classic Garment	160	B	2013.09.27	45.41
DK061	Quarry Sub	500	D	2013.09.27	339.28
DK062	Concord (EAP Films Theaters)	400	B	2013.09.30	41.76
DK063	Kalubowila Hiospital Bulk	1000	B	2013.09.30	249.09
DK064	Bernard Garment	630	B	2013.09.30	162.40
DK065	Tajeema	400	B	2013.09.30	15.59
DK066	Pizza Hut (Keels Res. Pvt. Ltd)	250	B	2013.11.04	46.69
DK067	MC Building Dehiwala	630	B	2014.4.24	0.23
DK068	Sanjaya Road	400	D	2013.11.04	152.93
DK069	MTN Tower	500	B	2013.11.04	100.54
DK070	Vandervert New	400	D	2013.12.11	93.88
DK071	Tex Fabrics	250	B	2013.12.11	64.31
DK072	Anderson Road	250	D	2013.12.11	127.20
DK073	Kadawatha Road New	250	D	2013.12.11	149.36
DK074	Sunandarama Rd	250	D	2013.12.20	125.87
DK075	Sakya	400	B	2013.12.20	8.53
DK076	Kalubowila Hospital	160	B	2013.12.20	5.2
DK077	Remond Road new (Removed)				-
DK078	SEYLAN Bank-Nugegoda	250	B	2013.12.20	36.60
DK079	Kalubowila Primary(Removed)				-
DK080	Suranimala Place	400	D	2013.12.20	18.53

DK081	Keels Super (P M Katriarachchi)	400	B	2013.12.23	119.36
DK082	Ekanayaka Road	400	D	2013.12.23	51.45
DK083	Bathiya Mawatha	250	D	2013.12.23	156.86
DK084	Cargills- Kohuwala	100	B	2013.12.26	56.27
DK085	Kohuwala Lugh	100	D	2013.12.26	47.22
DK086	Greenland	250	D	2013.12.26	140.65
DK087	Asian Hardware	160	B	2013.12.26	6.27
DK088	Highlevel Road	160	D	2013.12.26	72.09
DK089	Dharmaraja Mawatha	250	D	2013.12.27	89.11
DK090	ICC	250	B	2013.12.21	22.15
DK091	Julian Place Apart	100	D	2013.12.27	0.00
DK092	Ramanadan Avenue	400	D	2013.12.27	83.26
DK093	Keels - Papiliyana	160	B	2014.01.29	10.02
DK094	Green Park	160	D	2014.01.02	143.24
DK095	204, Highlevel Rd (Removed)				-
DK096	Siera Property (Removed)				-
DK097	Jayasingha Ground	250	D	2014.01.02	93.32
DK098	T.F.C House	160	D	2014.01.02	11.62
DK099	Seylan Merchant	100	B	2014.01.28	0.00
DK100	Dilshey (Pvt) Ltd	160	B	2014.01.08	8.97
DK101	kandi J Property	400	B	2014.01.08	55.27
DK102	Tsunami housing	160	D	2014.01.08	19.75
DK103	Chithrananda	100	B	2014.01.09	10.02
DK104	OPEL	100	B	2014.01.09	10.02
DK105	University of Kohuwala	100	D	2014.01.20	6.08
DK106	Vijitha Road	250	D	2014.01.09	134.64
DK107	Theological Seminary	250	B	2014.01.09	133.86
DK108	No.16, Vandervet Place	250	D	2014.01.10	6.52
DK109	Charks Place	250	D	2014.01.10	5.37
DK110	Calton Recidence	250	D	2014.01.10	12.00
DK111	Elvin Place Nugegoda	400	B	2014.01.13	51.19
DK112	No. 16, Presure avanue	100	D	2014.01.13	10.18
DK113	No239/2, Hill st, Wimbledon court	400	B	2014.01.13	20.21
DK114	(Removed)				-
DK115	Near Fashion Bug	630	D	2014.01.13	83.75
DK116	Shanthi Property Kohuwala	250	D	2014.01.16	6.83
DK117	M C Donal Nugegoda	250	B	2014.01.16	141.11
DK118	St .Jhosap Rd	250	D	2014.01.16	56.43
DK119	No. 45/1,Initiaem Rd	160	D	2014.01.16	4.41
DK120	Near M C Donald	600	D	2014.01.17	88.50
DK121	No,179 Dutugamanu St.	100	D	2014.01.17	9.54
DK122	46/A,Jayasinghe Mv	250	D	2014.01.17	17.25

DK123	Near Civi Mech	160	D	2014.01.17	70.02
DK124	De Silva Rd New	250	D	2014.01.21	79.58
DK125	Nikape -2	250	D	2014.01.21	126.21
DK126	Woodland Mv -New	250	D	2014.01.21	16.61
DK127	Saranankara New	160	D	2014.01.21	34.67
DK128	Somananda Rd Jun	250	D	2014.01.27	38.79
DK129	In front of Kalubivila PS	160	D	2014.01.27	26.37
DK130	67, Saranankara	100	D	2014.01.27	0.00
DK131	15, Athapaththu Rd.	160	D	2014.01.27	6.57
DK132	11, Initiam Rd.	100	D	2014.2.17	14.57
DK133	Yashodara gardens	160	D	2014.2.28	47.22
DK134	Cargills - Dehiwala	100	B	2014.02.17	36.30
DK135	L.H.S.Danistor - Nugegoda	400	B	2014.02.28	0.93
DK136	ICC - Kohuwala	250	B	2014.02.17	16.64
DK137	Clinic Gall Rd Noth	250	D	2014.02.17	37.5
DK138	210, Dutugemunu St.	100	B	2014.02.28	0.93
DK139	16A, Vendervet Pl.	100	B	2014.02.28	2.99
DK140	Sagis Campus	400	B	2014.03.03	7.72
DK141	CSI College	160	B	2014.02.28	0.00
DK142	Keels super Market-Kalubowila	400	B	2014.02.28	150.55
DK143	Rush Construction	250	B	2014.03.03	10.16
DK144	50, Anagarika Dharmapala Mw.	100	B	2014.03.04	43.26
DK145	Tex Febric Exports	100	B	2014.03.04	38.38
DK146	Wijemangalaramaya	250	D	2014.03.04	115.80
DK147	Trend Holding(pvt)Ltd.	100	B	2014.03.04	7.52
DK148	No:142 1/1, Galle rd, Rathmalana.	250	D	2014.03.03	40
DK149	Concord Ltd.	250	B	2014.03.04	51.74
DK150	Grand Property Dev,vandervert pl	100	B	2014.03.07	9.05
DK151	190B,Dutugemunu St.Kohuwala	160	B	2014.03.04	40.43
DK152	3,Wijayaba Mw.,Kohuwala	160	B	2014.03.04	27.49
DK153	Heck Fort Printers(Pvt) Ltd.	100	B	2014.03.07	19.17
DK154	Galvihara Lane, Dehiwala	250	B		
DK155	Globe Mirror, Dehiwala	100	B	2014.2.17	1.41
DK156	Sri Lanka Air Force Base,Dehiwala	250	D	Not Energised	-
DK157	Careekleen Pvt Ltd., Dehiwala.	100	B	2014.03.17	2.99
DK158	No.3, Kawdana Rd., Dehiwala.	160	B		1.61
DK159	No:7 A/1, Hospital Rd,	100	B	2014.03.04	15.41

[Appendix – C]

Feeders and Number of Consumers

PS	Feeder	Consumers
Kalubowila	F1	313
	F2	2503
	F3	3442
	F4	5007
	F5	3129
	F6	2816
Dehiwala	F1	2816
	F2	3536
	F3	376
	F4	1627
	F5	3223
Attidiya	F2	5602
	F3	3630
	F5	3098
	F6	3880
Total (Dehiwala Area)		45000

[Appendix – D]

Interruption Details of the MV Feeders (November 2014)

Date	Start	End	Duration	Feeder	Affected Consumers	Interruption Duration for all consumers (mins)	Unaffected consumers after new Proposals	Reduction of Consumer Interruption (mins)
	hh:mm	hh:mm	hh:mm					
Attidiya PS								
3-Nov	10:07	10:08	0:01	F2	5602	5602	0	0
8-Nov	21:08	21:20	0:12	F6	3880	46560	0	0
8-Nov	21:45	21:50	0:05	F6	3880	19400	0	0
9-Nov	9:34	9:36	0:02	F6	3880	7760	0	0
9-Nov	12:25	12:40	0:15	F6	3880	58200	0	0
20-Nov	12:12	15:30	3:18	F6	3880	768240	0	0
23-Nov	10:01	15:20	5:19	F2	5602	1787038	0	0
26-Nov	9:02	9:04	0:02	F5	3098	6196	2169	0
26-Nov	17:23	17:24	0:01	F5	3098	3098	2169	0
29-Nov	11:33	11:35	0:02	F3	3630	7260	0	0
30-Nov	9:02	17:00	7:58	F2	5602	2677756	0	0
30-Nov	9:35	9:36	0:01	F3	3630	3630	0	0
30-Nov	9:50	9:54	0:04	F3	3630	14520	0	0
30-Nov	16:32	16:33	0:01	F3	3630	3630	0	0
Dehiwala PS								
8-Nov	2:30	2:33	0:03	F3	376	1128	0	0
18-Nov	11:20	11:21	0:01	F5	3223	3223	2256	0
18-Nov	11:24	11:25	0:01	F1	2816	2816	0	0
19-Nov	8:48	16:05	7:17	F5	3223	1408451	2256	963354.7
20-Nov	7:55	7:57	0:02	F1	2816	5632	0	0
29-Nov	23:15	30-Nov 18:22	19:07	F1	2816	3229952	0	0
29-Nov	23:46	23:47	0:01	F5	3223	3223	2256	0
30-Nov	8:38	18:18	9:40	F5	3223	1869340	2256	1263416
30-Nov	9:41	17:07	7:26	F2	3516	1568136	0	0
30-Nov	9:58	17:07	7:09	F4	1627	697983	0	0
30-Nov	29-Nov 23:15	18:22	19:07	F1	2816	3229952	0	0
Kalubowila PS								
2-Nov	13:08	13:11	0:03	F4	5007	15021	3505	0
2-Nov	14:10	14:12	0:02	F4	5007	10014	3505	0
8-Nov	8:27	8:39	0:12	F2	2503	30036	0	0
10-Nov	8:42	8:43	0:01	F1	313	313	0	0
10-Nov	9:25	9:26	0:01	F6	2816	2816	1971	0
10-Nov	9:26	9:56	0:30	F6	2816	84480	1971	39424
10-Nov	9:57	9:58	0:01	F5	3129	3129	2190	0
10-Nov	10:33	11:30	0:57	F5	3129	178353	2190	102944
10-Nov	11:28	11:29	0:01	F6	2816	2816	1971	0
10-Nov	16:00	16:01	0:01	F1	313	313	0	0
11-Nov	10:10	10:11	0:01	F3	3442	3442	2409	0
11-Nov	14:31	14:32	0:01	F3	3442	3442	2409	0
13-Nov	1:39	1:40	0:01	F6	2816	2816	1971	0

17-Nov	14:27	14:28	0:01	F3	3442	3442	2409	0
18-Nov	10:35	20-Nov 7:35	21:00	F1	313	394380	0	0
18-Nov	10:35	20-Nov 7:55	21:20	F2	2503	3203840	0	0
18-Nov	10:35	20-Nov 7:25	20:50	F3	3442	4302500	2409	2987656
18-Nov	10:35	10:55	0:20	F4	5007	100140	3505	35049
18-Nov	10:35	10:55	0:20	F5	3129	62580	2190	21903
18-Nov	10:35	10:55	0:20	F6	2816	56320	1971	19712
19-Nov	18-Nov 10:35	14:35	28: 00	F2	2503	4205040	0	0
20-Nov	18-Nov 10:35	7:25	20:50	F3	3442	4302500	2409	2987656
20-Nov	18-Nov 10:35	7:35	21:00	F1	313	394380	0	0
20-Nov	18-Nov 10:35	7:55	21:20	F2	2503	3203840	0	0
21-Nov	11:25	11:34	0:09	F4	5007	45063	3505	0
22-Nov	22:54	22:55	0:01	F1	313	313	0	0
23-Nov	8:17	8:18	0:01	F1	313	313	0	0
23-Nov	8:52	8:53	0:01	F5	3129	3129	2190	0
23-Nov	9:27	9:28	0:01	F5	3129	3129	2190	0
23-Nov	15:08	15:09	0:01	F1	313	313	0	0
23-Nov	16:43	16:44	0:01	F5	3129	3129	2190	0
23-Nov	17:40	17:44	0:04	F6	2816	11264	1971	0
26-Nov	3:04	3:05	0:01	F2	2503	2503	0	0
29-Nov	22:48	22:49	0:01	F3	3442	3442	2409	0
29-Nov	23:16	23:17	0:01	F2	2503	2503	0	0
30-Nov	7:52	7:53	0:01	F6	2816	2816	1971	0
30-Nov	10:20	10:21	0:01	F3	3442	3442	2409	0
30-Nov	10:35	10:36	0:01	F3	3442	3442	2409	0
30-Nov	17:19	17:20	0:01	F2	2503	2503	0	0
Total (mins)						**17,765,717**		**2,369,139**
SAIDI (mins/Consumer)						**394**		**53**

[Appendix – E]

Interruption Details of the MV Feeders (December 2014)

Date	Start	End	Duration	Feeder	Affected Consumers	Interruption Duration for all consumers (mins)	Unaffected consumers after new Proposals	Reduction of Consumer Interruption (mins)
	hh:mm	hh:mm	hh:mm					
Attidiya PS								
2-Dec	17:43	18:45	1:02	F2	5602	347324	0	0
3-Dec	9:13	9:14	0:01	F5	3098	3098	2169	0
3-Dec	9:29	15:43	6:14	F3	3630	1357620	0	0
3-Dec	15:45	15:47	0:02	F5	3098	6196	2169	0
3-Dec	17:11	17:15	0:04	F5	3098	12392	2169	0
5-Dec	17:13	17:16	0:03	F2	6502	19506	0	0
18-Dec	15:35	15:36	0:01	F2	6502	6502	0	0
20-Dec	9:21	10:02	0:41	F2	6502	266582	0	0
20-Dec	9:15	9:16	0:01	F2	6502	6502	0	0
25-Dec	21:48	21:58	0:10	F2	6502	65020	0	0
31-Dec	16:04	16:06	0:02	F2	6502	13004	0	0
Dehiwala PS								
5-Dec	17:20	17:21	0:01	F2	3536	3536	0	0
6-Dec	19:27	19:28	0:01	F5	3223	3223	2256	0
6-Dec	19:52	19:53	0:01	F5	3223	3223	2256	0
Kalubowila PS								
2-Dec	16:46	16:47	0:01	F5	3129	3129	2190	0
2-Dec	17:27	17:28	0:01	F5	3129	3129	2190	0
2-Dec	16:46	16:46	0:00	F6	2816	0	0	0
2-Dec	17:27	17:28	0:01	F5	3129	3129	2190	0
4-Dec	17:16	17:45	0:29	F5	3129	90741	2190	43806
4-Dec	17:18	17:45	0:27	F6	2816	76032	1971	39424
4-Dec	19:35	19:37	0:02	F5	3129	6258	2190	0
4-Dec	19:35	19:37	0:02	F6	2816	5632	1971	0
5-Dec	3:50	3:51	0:01	F3	3442	3442	2409	0
7-Dec	8:57	8:58	0:01	F3	3442	3442	2409	0
9-Dec	18:10	18:45	0:35	F3	3442	120470	2409	60235
9-Dec	19:13	19:15	0:02	F3	3442	6884	2409	0
24-Dec	8:04	8:05	0:01	F4	5007	5007	2409	0
31-Dec	8:19	8:20	0:01	F4	5007	5007	3505	0
31-Dec	10:50	10:53	0:03	F3	3442	10326	2409	0
31-Dec	14:20	15:45	1:25	F3	3442	292570	2409	180705
Total (mins)						2,748,926		324,170
SAIDI (mins/Consumer)						61		7

[Appendix – F]

Interruption Details of the MV Feeder (January 2015)

Date	Start	End	Duration	Feeder	Affected Consumers	Interruption Duration for all consumers (mins)	Unaffected consumers after new Proposals	Reduction of Consumer Interruption (mins)
	hh:mm	hh:mm	hh:mm					
Attidiya PS								
6-Jan	10:02	10:03	0:01	F3	3630	3630	0	0
6-Jan	15:35	15:36	0:01	F5	3098	3098	2169	0
7-Jan	10:50	10:54	0:04	F2	5602	22408	0	0
10-Jan	14:14	14:15	0:01	F2	5602	5602	0	0
21-Jan	8:46	8:47	0:01	F2	5602	5602	0	0
28-Jan	21:03	21:04	0:01	F2	5602	5602	0	0
28-Jan	21:34	21:43	0:09	F2	5602	50418	0	0
Dehiwala PS								
29-Jan	18:04	18:05	0:01	F1	2816	2816	0	0
29-Jan	18:09	18:10	0:01	F1	2816	2816	0	0
29-Jan	18:16	18:17	0:01	F1	2816	2816	0	0
29-Jan	18:20	19:53	1:33	F1	2816	261888	0	0
Kalubowila PS								
1-Jan	15:41	15:42	0:01	F2	2503	2503	0	0
3-Jan	12:35	12:52	0:17	F5	3129	53193	2190	0
3-Jan	13:25	13:26	0:01	F5	3129	3129	2190	0
3-Jan	13:54	13:55	0:01	F5	3129	3129	2190	0
3-Jan	14:01	14:02	0:01	F6	2816	2816	1971	0
3-Jan	14:24	14:25	0:01	F5	3129	3129	2190	0
3-Jan	15:06	15:07	0:01	F5	3129	3129	2190	0
3-Jan	15:08	15:09	0:01	F6	2816	2816	1971	0
3-Jan	16:12	16:13	0:01	F5	3129	3129	2190	0
3-Jan	16:37	16:38	0:01	F5	3129	3129	2190	0
3-Jan	17:45	17:46	0:01	F5	3129	3129	2190	0
3-Jan	19:30	19:31	0:01	F6	2816	2816	1971	0
3-Jan	19:55	19:56	0:01	F5	3129	3129	2190	0
3-Jan	19:55	19:56	0:01	F6	2816	2816	1971	0
4-Jan	10:05	10:06	0:01	F5	3129	3129	2190	0
4-Jan	10:47	10:48	0:01	F5	3129	3129	2190	0
7-Jan	16:01	16:02	0:01	F2	2502	2502	0	0
7-Jan	16:30	16:31	0:01	F2	2502	2502	0	0
7-Jan	20:14	20:15	0:01	F4	5007	5007	3505	0
7-Jan	21:05	21:13	0:08	F4	5007	40056	3505	0
12-Jan	13:48	13:48	0:00	F2	2502	0	0	0
19-Jan	11:28	11:37	0:09	F2	2502	22518	0	0
20-Jan	9:07	9:08	0:01	F3	3442	3442	2409	0
20-Jan	17:11	17:12	0:01	F3	3442	3442	2409	0
25-Jan	7:13	16:50	9:37	F3	3442	1986034	1721	975807
25-Jan	7:27	7:28	0:01	F2	2503	2503	0	0
25-Jan	8:57	8:59	0:02	F1	313	626	0	0
25-Jan	9:15	16:30	7:15	F4	5007	2178045	2504	1063988

25-Jan	9:15	16:30	7:15	F5	3129	1361115	1565	664913
25-Jan	9:15	16:30	7:15	F6	2816	1224960	1408	598400
25-Jan	9:15	16:00	6:45	F1	313	126765	0	0
25-Jan	9:15	16:00	6:45	F2	2503	1013715	0	0
25-Jan	9:15	16:00	6:45	F3	3442	1394010	1721	679795
29-Jan	18:10	18:11	0:01	F4	5007	5007	3505	0
30-Jan	11:49	11:50	0:01	F4	5007	5007	3505	0
Total (mins)						**9,842,202**		**3,982,902**
SAIDI (mins/Consumer)						**218**		**89**