Chapter 6

Economic Evaluation

The implementation of network reinforcement proposals incurs substantial costs to the utility. With a view to lessen the burden on the utility, the network reinforcement proposals have been spread throughout the planning period in such a manner that those are implemented exactly as and when necessary. This in turn stagger the investments and helps smooth cash flow.

Network reinforcements improve the safety and reliability of the network and quality of power. Further, it enhances the capacity of the network, thus improving the distribution requirement to satisfy the demand for electricity. All those improvements are contributing to higher productivity, better living standards and customer satisfaction. Therefore the cost involved shall be viewed as a highly beneficial investment.

Economic evaluation has been carried out to assess the costs and benefits of the proposed investment. Costs have been estimated using the CEB standard rates and the individual rates of components purchased/installed recently. Network reinforcement costs required for enhancement of LECO demands have also been added for the costs. Benefits are two folds; quantifiable and unquantifiable. Benefits from improvement of network voltage and supply reliability are difficult to quantify. The readily quantifiable benefit is the reduction of power and energy losses. Only this benefit has been considered for the analysis.

In fact the plant and equipment (grid substations, MV tower lines etc) proposed to be installed have longer life spans for beyond the current planning period. For a proper analysis of benefits, the life cycle costs and benefits should be also considered. However in this study this matter has not been considered.

The implementation of the reinforcement proposals will reduce the required power and the energy of the proposed networks. These figures have been obtained by load flow studies.

6.1 Power Loss Reduction and Savings

Year	2009	2010	2011	2012	2013
Power Demand (MW)					
Existing Network	190.6	210.1	226.6	245.6	266.1
Proposed Network	190.6	205.1	222.4	240.6	259.2
Power Loss (MW)					
Existing Network	5.7	8.4	11.1	13.5	16.5
Proposed Network	5.7	4.7	5.6	5.3	6.2
Power Savings (MW)	0	3.7	5.5	8.2	10.3
Power Loss %					
Existing Network	3.0	4.0	4.9	5.5	6.2
Proposed Network	3.0	2.3	2.5	2.2	2.4
Cost of Power Savings (MRs)	0	73.9	109.8	163.7	205.6

Table - 6.1 Power Loss Reduction and Savings

In the table 6.1, Cost of Power saving is calculated using CEB's capacity cost Rs 19,961.00 per kW.

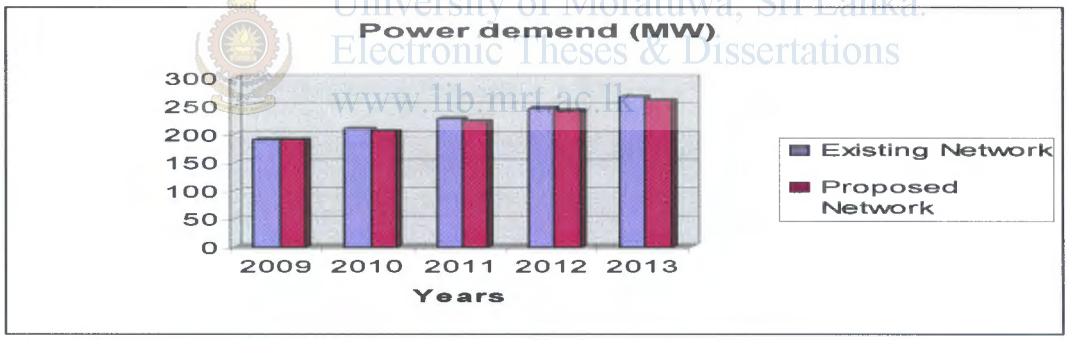

Figure 6.1(a) Power Demand Vs Years

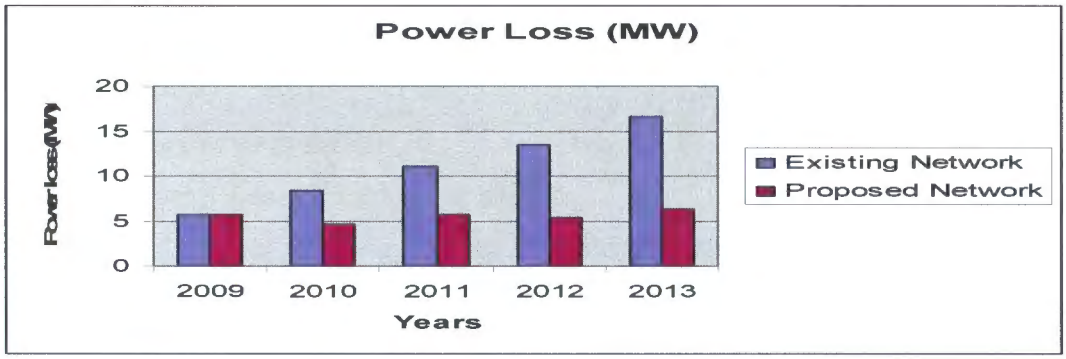

Figure 6.1(b) Power Loss Vs Year

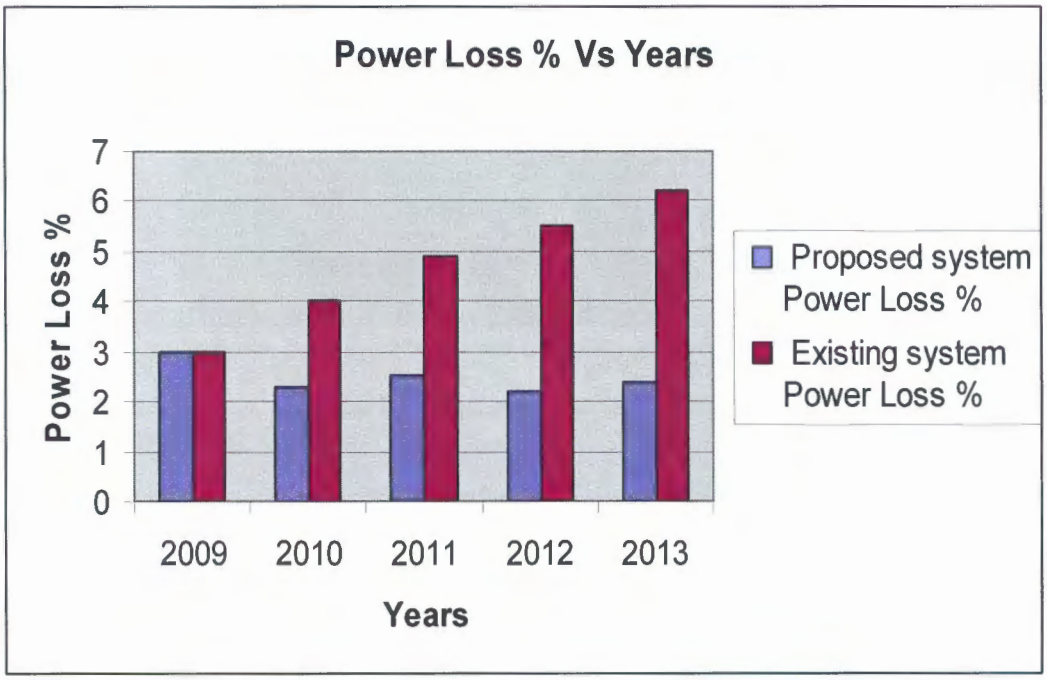

Figure 6.1 (c) Peak Power Loss % Vs Years

6.2 Energy Loss Reduction and Savings

Year	2009	2010	2011	2012	2013
Energy Demand (GWh/Year)					
Existing Network	916.4	1022.1	1108.9	1203.3	1310.7
Proposed Network	916.4	1018.3	1107.3	1201.1	1304.1
Energy Loss (GWh/Year)					
Existing Network	18.2	22.4	26.6	31.9	38.2
Proposed Network	18.2	12.1	13.8	15.0	16.0
Energy Savings (GWh/Year)	0	10.3	12.8	16.9	22.2
Enegy Loss %					
Existing Network	2.0	2.2	2.4	2.7	2.9
Proposed Network	2.0	1.2	1.2	1.2	1.2
Cost of Energy Savings (MRs)	0	71.4	88.7	117.1	153.9

Table - 6.2 Energy Loss Reduction and Savings

In the table 6.2, Cost of Energy saving is calculated using CEB's energy cost Rs 6.93/kWh.

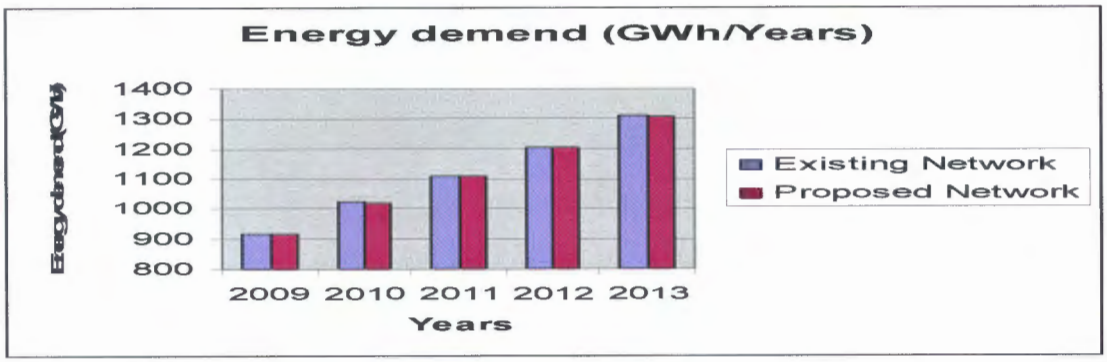

Figure 6.2(a) Energy Demand Vs Years

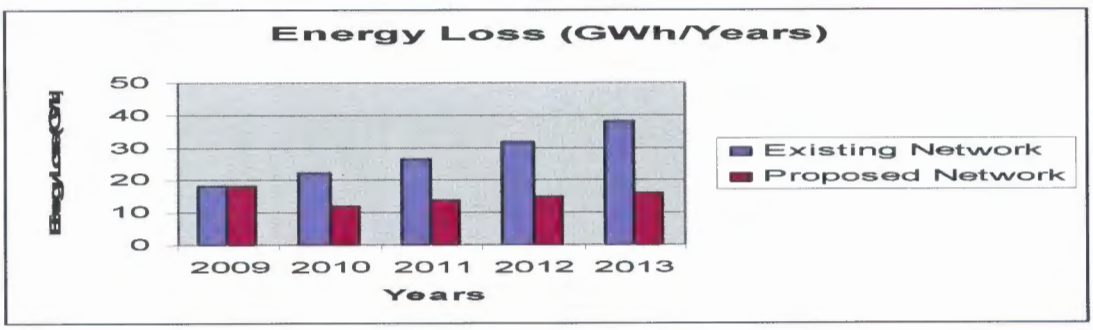

Figure 6.2 (b) Energy Loss Vs Years

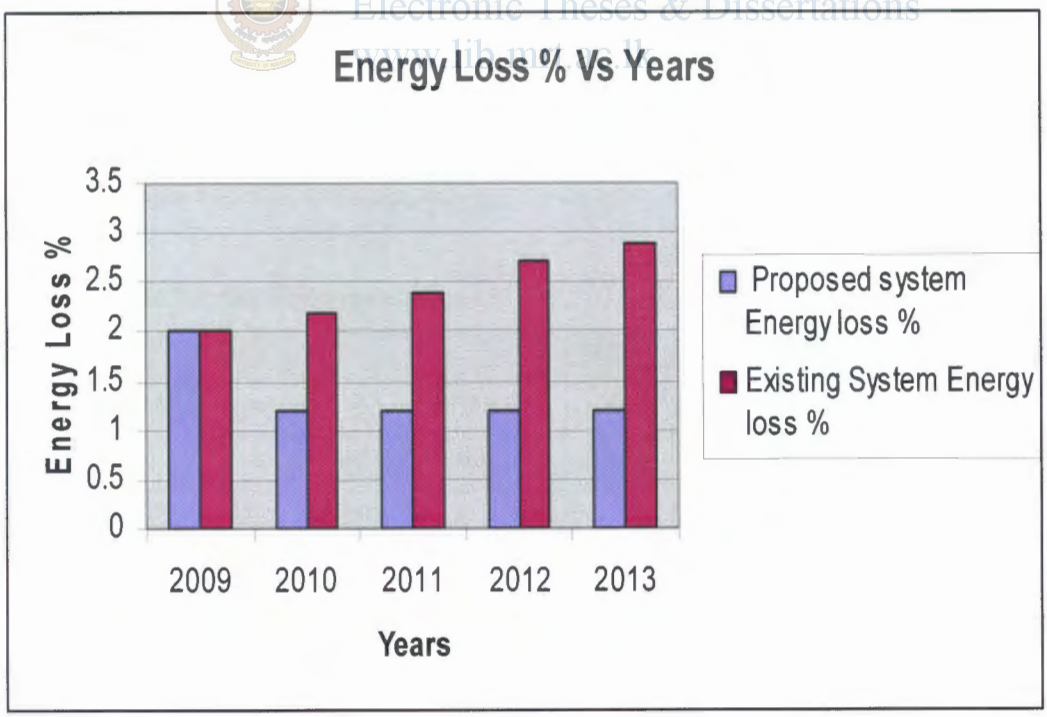

Figure 6.2 (c) Energy Loss % Vs Years

6.3 Overall Scope of Implementation

The total implementation of the reinforcement proposals are given in the table 6.3

No	Item	2010	2011	2012	2013	Total
1	New GSS (Nos)	01	-	-	-	01
2	New 33 kV UG cable (km)	05	-	-	-	05
3	Reconductoring Racoon to Lynx SC (km	-	1.5	3.5	5	10
4	Conversion Lynx SC to Lynx DC (km)	4.5	-	-	-	4.5
5	Conversion Racoon DC to Lynx DC (km)	-	4	-	-	4

Table 6.3 Overall Scope of Implementation

6.4 Cost of Implementation

Item	Unit	Cost (Rs)
New Grid Substation (2X 10 MVA)	Nos	160 M
New 33 kV Underground cable line	km	40 M
Reconductoring – Racoon SC to Lynx SC	km	4.5 M
Conversion – Lynx SC to Lynx DC	km	8.0 M
Conversion – Racoon SC to Lynx DC	km	6.0 M
Energy cost	kWh	6.93
Capacity cost (depreciation and interest)	kW	19,961.00
Rate of interest for NPV calculation	10% per annum.	

6.5 Costs for the Implementation (MRs)

	Item	2010	2011	2012	2013	Total
1	New Grid Substation (2X 10 MVA)	160	-	-	-	160
2	New 33 kV Underground cable line	200	-	-	-	200
3	Reconductoring – Racoon SC to Lynx SC	-	6.8	15.8	22.5	45.1
4	Conversion – Lynx SC to Lynx DC	27	-	-	-	27
5	Conversion – Racoon SC to Lynx DC	-	32	-	-	37
	Total	**387**	**38.8**	**15.8**	**22.5**	**464.1**

Table 6.5 Cost for the Implementation (MRs)

6.6 Total Loss Reduction and Savings (MRs)

Year	2009	2010	2011	2012	2013	Total
Cost of Power Savings	0	73.9	109.8	163.7	205.6	553.0
Cost of Energy Savings	0	71.4	88.7	117.1	153.9	431.1
Total Cost of Power & Energy Savings	0	145.3	198.5	280.8	359.5	984.1
Discounted Cost of Savings	0	132.1	164.1	211.0	245.5	752.7
Cost of proposed reinforcement @ current prices	0	387	38.8	15.8	22.5	464.1

Table 6.6 Total Loss Reduction and Savings

6.7 Calculation of Benefit / Cost Ratio

Expected quantifiable benefit from the implementation of the proposals = Rs 752.7 M

Estimated cost for the proposed reinforcement @ current prices = Rs 464.1 M

Therefore benefit/ cost ratio = 752.7/464.1 = 1.62

Therefore this project is viable. In fact the plant and equipment proposed to be installed have longer life spans for beyond the current planning period. For a proper analysis of benefits the life cycle costs and benefits should be also considered. However in this study this matter has not been considered.

6.8 Unquantifiable Benefits

Upgrading the network capacity is achieved by reinforcing the network with new grid substations, MV lines etc., so that the network shall be able to supply the increased power demand, maintaining the proper voltage levels at minimum losses. Implementation of network reinforcement proposals of this study would ensure adequate level of upgrading of the overall network capacity to the future demand effectively and efficiently.

According to this study for 2009 -2013, within Western Province South-I, the overall network capacity will be upgraded to handle a demand of 260 MW in year 2013 from the present level of 190 MW (in the year 2009).

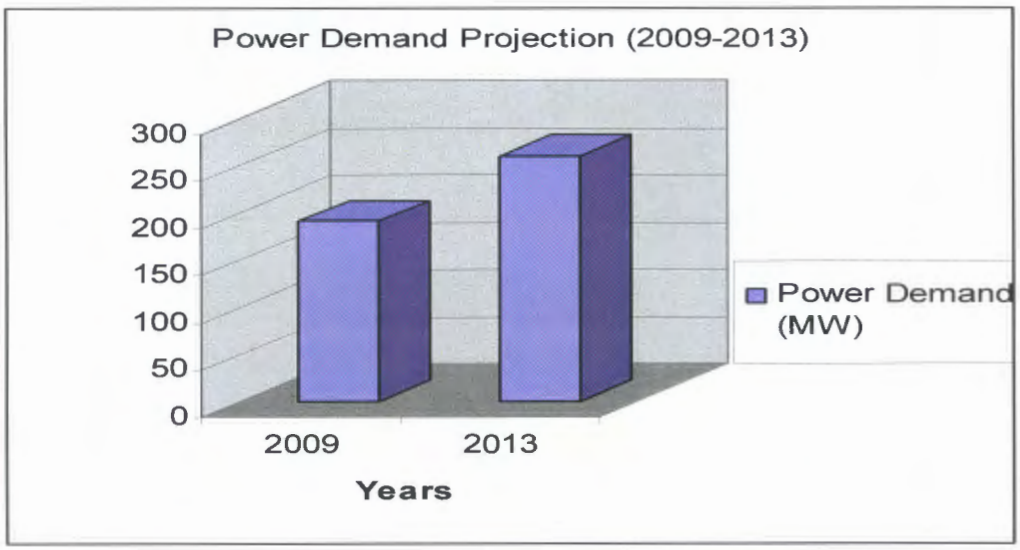

Figure 6.8(a) Power demand Projections

It is important to ensure adequate capacity is available at each individual locations of the network. Voltage levels in the network can be considered as a rough measure access availability of network capacity.

Voltage at some locations cannot be improved to accepted levels owing to the fact that those are far away from the grid substation. For such locations specific solutions such as voltage compensation techniques (E.g.: voltage regulators, feeding from primary substations with automatic tap changers) should be considered in addition to implementation of proposals given in this study.

Other such projects include installing capacitors on MV lines. Capacitor installation is very cost-effective. It is economical for to correct MV network power factor close to unity. This does not reduce losses very significantly, however, would be a minor element in the total loss reduction programme.

Based on the load forecast and grid substations enhancement proposals, system demand and available grid capacity compare as follows [table 6.8 and figure 6.8(b)].

Year	2009	2010	2011	2012	2013
Power Demand (MW)	190.6	205.1	222.4	240.6	259.2
Total GSS Capacity (MVA)	330	350	350	350	350

Table 6.8 –Power Demand and Grid Capacity

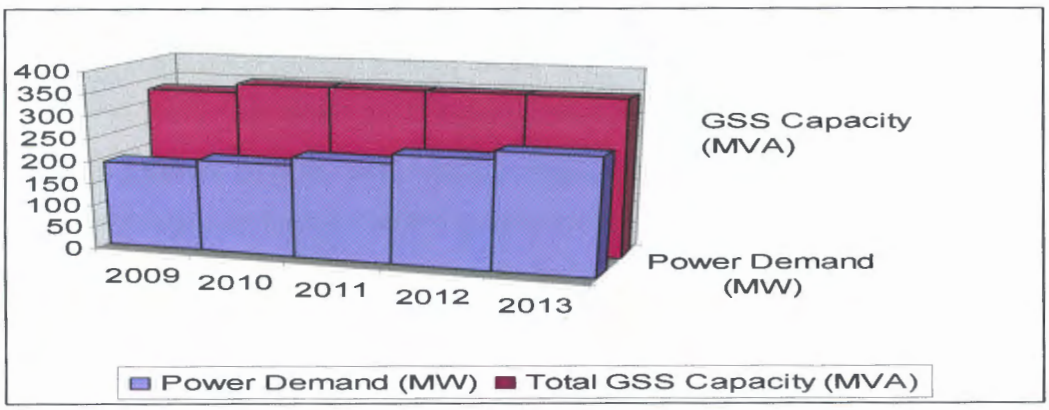

Figure 6.8 (b) - Power Demand and Grid Capacity