

DESIGN OF COLOMBO CITY ELECTRICITY NETWORK FOR ANTICIPATED FUTURE DEMAND

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June 2015

DECLARATION

“I declare that this is my own work and this 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.

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ABSTRACT

In “Colombo City Development Plan – 2020” published by Urban Development Authority in 2008, Colombo City is divided into 9 zones based on the major developments in each zone. The major projects proposed to be completed by 2020 are sited in concentrated development zone and port related activity zone. With the upcoming projects in each zone, the amount of electricity required in each zone will be increased and existing load centers will be shifted. Specially commercial and industrial zones will require higher amount of energy. With the zoning plan & upcoming projects most of the grid substations with two numbers of transformers & underground cables will be fully overloaded during peak hours in future. Therefore tripping of one transformer and/or underground cable will cause power interruptions to large number of industrial and domestic customers since rest of the network can't cater the demand. This is due to the capacity limitation of the present transformers, limitation of the number of transformers in each GSS, capacity limitations of underground cables and not having GSSs in required load centers. These are major setbacks in Colombo City system operation and reliability.

Presently Colombo city distribution network is operating at 11 kV voltage level. Due to this voltage level, with the future growing demand network loss will also grow drastically. In addition to the line losses, present transformer impedances also contribute to these losses.

This dissertation discusses on designing of an upgraded network for Colombo City in 2021 with minimum overloading of transformers and underground cables. Further, analysis is done to examine the best transmission voltage in 2021 according to the demand growth.

Load forecast was prepared up to 2021 based on past data obtained from system control center of Ceylon Electricity Board and spot load data obtained from UDA. Accordingly, the load centers are identified. Sri Lankan power system has been modeled using the PSS@E (Power System Simulator for Engineers) software. The Existing Colombo City Electricity Network was simulated using this model and its drawbacks were identified. Two effective networks i.e. 132 kV solution and 220 kV solution, were proposed for Colombo City in 2021 and system improvements were tested with simulations. The observations and results obtained from the simulations include short circuit levels and transmission losses. Economic and financial analysis was carried out and finally comparing all the results the most effective network for Colombo City in 2021 was selected.

This newly proposed network for Colombo City in 2021 will improve the Power System reliability and have a definite positive effect on customers which in turn improve the welfare of the people and economy of the country.

Key words: Load Centers, Short Circuit Levels, Network Losses, Simulations, Network, Reliability.

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Abbreviations

Abbreviation	Meaning
GS	Grid Substation
GSs	Grid Substations
GIS	Gas Insulated Switchgear
SUB	Substation
UDA	Urban Development Authority
OHL	Overhead Line



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