IMPACT OF EMBEDDED GENERATION ON DISTRIBUTION LOSS MINIMIZATION

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by
RATNAYAKA MUDIYANSELAGE SHAMINDA
MANUJAYA BANDARA SUMANASEKARA

Supervised by: Eng. W.D.A.S.WijayapaJa
Dr.H.M.Wijekoon

Department of Electrical Engineering
University of Moratuwa, Sri Lanka

2010

Abstract

Demand for Electricity has been increasing rapidly over the last decade and the cost of electricity generation too has been increasing due to the adverse impacts on hydro resources. Electricity loss reduction is a main concern to minimize the heavy cost on electricity generation. It has shown progress over the last five years by minimizing system losses by 5%.

Embedded generation has direct impact on the distribution loss level of the system due to the alteration in power flow. Absorption of the optimal output of the potentially available embedded generation is therefore important for the utility. It needs adequate facilitation for the developers and optimal allocation of these plants on the network.

Network analysis was carried out on a network in actual terms. Power flow study through Synergee software considering various arrangements of grid interconnection of embedded generators, was the approach. Key concerns on the simulation study was the reduction in distribution line losses, reduction in grid power demand where central generation replaced by embedded generation and the reduction in grid transformer losses due to altered current flows. The study consisted of analyzing the absorption of all potentially available capacity into the feeder. The optimal arrangement was compared with the conventional arrangement proposed by CEB thereby evaluating the profitability of the modified connection arrangement through NPV calculation.

Analysis revealed that connecting the embedded generators to the nearby load centers of the network has significant effect compared to connecting them to nearest branch of the distributor. It causes' a reduction in network losses and cost of generation due to the decrease in power demand by the transmission network. The effect is high when power from large capacity generators is directly transported to the load centers. A typical network would make an internal rate of return about 26% through the modification in the long run.

This could be employed in the planning process for preparation of the grid interconnection proposals for embedded generators.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated. It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

R.M.S.M.B.Sumanasekara

Date : 01-02-2016

We endorse the declaration by the candidate.

UOM Verified Signature

Eng. W.D.A.S.Wijayapala

UOM Verified Signature

Dr. H.M.Wijekoon

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R.M.S.M.B.Sumanasekara

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LIST OF ACRONYMS

ACSR - Aluminum Conductor Steel Reinforced

CEB - Ceylon Electricity Board

EG - Embedded Generation

GSS - Grid Substation

HFO - Heavy Fuel Oil

HV - High Voltage

IRR - Internal Rate of Return

LV - Low Voltage

MHP - Mini Hydro Plant

MV - Medium Voltage

NPV - Net Present Value

O&M - Operation and Maintenance

PCC - Point of Common Coupling

PU - Per Unit

RC - Reinforced Concrete

SPPA - Standardized Power Purchase Agreement

UG - Underground