ANALYSIS OF POWER QUALITY ISSUES DUE TO THE PROPOSED SOLAR POWER PLANTS IN HAMBANTOTA

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

December 2014

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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Signature of the supervisor Date:

(Prof. J. P. Karunadasa)

ABSTRACT

Solar power plants, despite their high initial investment are fast spreading in Asian countries owing to the availability of higher solar radiation throughout the day time. In Sri Lanka, two grid connected small scale solar power plants of 737 kW, 500 kW are already in operation located in Baruthankanda, Hambantota.

Three private developers have made proposals for another 30 MW solar plants, (each 10 MW) near the existing plants which would be directly connected to 33kV Bus at Hambantota GSS. However, unpredictable variations in the source of energy and power electronic converters of such a large solar power plant can create a significant impact on the existing power system in power quality point of view.

This thesis describes the details of a study carried out on the probable impacts on power quality at the GSS due to random fluctuation of solar radiation level for different system-design options of the proposed 30 MW plant. Standards IEEE 519-1992 and IEEE 1547-2003 were used in the power quality check-up.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
SEA	Sustainable Energy Authority
PSCAD	Power Systems Computer Aided Design
P&D	Planning & Development
EE	Electrical Engineer
ES	Electrical Superintendent
IEEE	Institute of Electrical & Electronic Engineers
TDD	Total Demand Distortion
NCRE	Non- Conventional Renewable Energy
GSS	Grid Sub Station
PV	Photo Voltaic
DC	Direct Current
AC	Alternative Current
STC	Standard Test Conditions
MPPT	Maximum Power Point Tracking
IC	Incremental Conductance
P&O	Perturb & Observe
THD	Total Harmonic Distortion
PCC	Point of Common Coupling
DR	Distributed Resource
RMS	Root Mean Square
DDLO	Drop Down Lift Off
ABS	Air Break Switch
EMTDC	Electro Magnetic Transients including DC
IGBT	Insulated gate Bipolar Transistor
PWM	Pulse Width Modulation

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