

**ASSESSMENT OF FACTORS AFFECTING SOLAR
IRRADIANCE AND DEVELOPMENT OF A MODEL
FOR PREDICTIONS**

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Department of Electrical Engineering

University of Moratuwa
Sri Lanka

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

Supervised by: Eng. W.D.A.S. Wijayapala

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

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Signature of the supervisor
(Eng. W.D.A.S.Wijayapala)

Date:

ABSTRACT

In Sri Lanka Ceylon Electricity Board plays the role of the system controller by dispatching the energy generated from different power plants to meet the energy demand. Power generation from renewable energy sources such as wind, mini-hydro, solar etc is becoming increasingly popular due to environmental concerns. With the introduction of the net metering system a large number of rooftop solar power systems are getting connected to the national grid.

However, it is not possible to predict the energy generation of solar power plants in advance. Therefore, the system controller has no information about the tomorrow's possible energy availability from these non-dispatchable power plants. Then the only option left with the system controller is to reserve the costly thermal power plants in order to meet the future energy demand. The outcome of this research enables the system controller to predict the possible energy generation from solar power plants based on the weather forecasts. This will provide the system controller with predictions on energy generation and capacity of solar power plants connected to the grid. These predictions will enable to prepare the dispatch schedules accordingly.

In this study, the effect of the geographical and meteorological parameters for predicting daily global solar radiation in Sooriyawewa, Hambantota is investigated. A multiple linear regression was applied to explain the relationship among solar radiation and identified geographical and meteorological parameters such as cloud cover, sunshine duration, precipitation, open air temperature, relative humidity, wind speed, gust speed, and sine of declination angle. Variables in these equations were used to estimate the global solar radiation. Values calculated from models were compared with the actual measurements to validate the model. The application of the model to other geographical locations should be carried out as a further study when sufficient data is available for such locations.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AWS	Automatic Weather Station
CEB	Ceylon Electricity Board
MBE	Mean Bias Error
MPE	Mean Percentage Error
NREL	National Renewable Energy Laboratory
NSE	Nash Sutcliffe Equation
RMSE	Root Mean Square Error
SEA	Sustainable Energy Authority



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