OPTIMUM SELECTION OF SOLAR SYSTEMS FOR NET METERED CONSUMERS A CASE STUDY : COLOMBO CITY

Asanka Janaka Edirisinghe

109210 P

University of Moratuwa, Sri Lanka.
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Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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Master of Science in Electrical Engineering

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

May 2015

DECLARATION

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Abstract

This paper presents the optimum selection criteria of a PV solar system for net metered consumers. This was done as a case study in Colombo City with optimization of five parameters which directly affect the output of PV solar system. Five parameters are tilt angle, azimuth angle, shadow possibilities, array size, and inverter capacity.

Geography and the climate in Sri Lanka justify the capability of harnessing the solar energy under net metering concept. Extreme motivation and guidance for this research came due to direct involvement in implementing net metering scheme in Colombo south area in CEB.

Highest solar insolation level in Colombo City reaches 5.09 kWh/m^2/day in March. If the monthly electricity consumption is between 360-510 kWh, optimum benefits could be achieved by consumers who have installed 3 kW systems in domestic tariff (D1) category. A domestic consumer with average consumption of 225 kWh can achieve a 10 year payback. The analytical model developed with weighted marking scheme will assist a designer to select the best combination of inverter and solar panel for a particular location.

Best tilt angle in Colombo city is 6^o, 7^o and 8^o. Tilt of tile roof is 30^o which is the most common in domestics. Maximum 6.13% energy is lost due to use of tile roofs for solar PV even with the best azimuth angle (5^o to 15^o away from south toward east direction). If the Shadow Free percentage is less than 60%, the PV solar system should not be installed though the effectiveness factor is 80%. Peak point of the benefits can be reached through selecting an optimum rated power of the inverter to be 77%-91% to that of the solar panel capacity.

Investing in a net metering PV solar system is more beneficial compared to an investment with the return of even 12% interest rate. Domestic tariff (D1) provides highest benefits to a net metering consumer.

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Key words: Net Metering, Insolation, Tilt Angle, Azimuth Angle

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LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
PV	Photo Voltaic
C-Si	Single crystal silicon
mc-Si	multi crystal silicon
GaAs	Gallium arsenide
a-Si	Amorphous silicon
CuInSe2	Copper Indium Deselienide
CIGS	Copper Indium Gallium Deselenide
CdTe	Cadmium telluride
NASA	National Aeronautics and Space Administration
ASDC	Atmospheric Science Data Center
EOS	Earth Observing System
DAAC	Distributed Active Archive Center
EOSDIS	Earth Observing System Data and Information System
SPP	Simple Payback Period

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