FIELD PERFORMANCE AND ENERGY COST ANALYSIS OF PHOTOVOLATIC MODULES

By

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CERTIFICATE

I am satisfied that the Thesis entitled " Field Performance and Energy Cost Analysis of Photovoltaic Modules " presented by Mukesh Chander is worthy of consideration for the award of the Degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by him under my guidance and supervision and that the results contained in it have not been submitted in part or full to any other university or institute for the award of any degree/diploma.

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ABSTRACT

This work is centred round two aspects of photovoltaic (PV) systems, field performance of photovoltaic modules and energy cost reduction of photovoltaic systems. These are important factors for characterizing the system reliability and performance.

The field performance of different types of PV modules has been studied in a tropical country as India. The study has been carried out with flatplate modules of amorphous, crystalline and polycrystalline silicon solar cells and concentrator modules of silicon solar cells. Concentrator modules have been exposed in the sun light for more than two years and they showed more than 50% degredation. The cause of failure was primarily because of poor module encapsulation and corrosion at contacts.

The flat plate modules of different types of solar cells have shown nearly the similar thermal behaviour. It has been observed that the efficiencies in the field environment are always lower than their rated values. The loss in power of the modules in the field condition has been due to mismetch loss, thermal lon presence of diffuse radiation and ohmic losses. The energy output enhacement using tracking and boosting mirrors has been investigated at Delhi and it has been shown that dual axis tracking without boosted mirrors are more cost effective. The annual energy enhancement using boosted mirrors (C=2x) was only 30% higher as compared to

fully tracking array because of presence of more scattered radiations. The dual axis tracking enhances the annual energy by 30-40% as compared to fixed latitude tilted PV system. The monthly performance advantage show variation of from 20 to 50%.

A single axis automatic sun tracker has been fabricted and studied. The performance of a dual axis tracker of SO-PHOCLE-100 has been studied and required modifications have been done to suit Indian conditions.

The energy cost analysis results indicate that dual axis tracking PV systems are more economical as compared to other orientations at present cost of PV modules and balance of system.

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