Universiti Teknologi MARA

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 6, Issue 6 November 2014

SIXTH ISSUE

INSTITUTE of GRADUATE STUDIES

Leading You To Greater Heights, Degree by Degree

IPSis Biannual Publication

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Title :
A New Technique In Evaluation Of Stabilisation For The Design Of Amorphous Silicon Photovoltaic Modules In Grid Connected System Under Equatorial Climate

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The use of thin-film photovoltaic (TFPV) technology is becoming more important with the increasing demands on PV installations in the full humid equatorial climate (Af) country such as Malaysia. There is a lack of literature on performance characterization of the grid-connected photovoltaic (GCPV) systems as well as a method in identifying the instability behaviour in TFPV technology, especially in this region. In this study, research on amorphous-Silicon (a-Si) based single-junction (SJ) TFPV technology was undertaken to find out the environmental suitability of the GC systems in Af climate. Three objectives have been identified: influence of Af climate on a-Si SJ TFPV technology on system performance, method of assessing the stabilization stages due to light-induced degradation (LID) phenomenon, designing on TFPV derating factor in matching of an Inverter-to-Array Power (IAP) ratio. This study includes field-test and analytical work on a newly installed GCPV system using a-Si SJ TFPV technology. The GC SJ TFPV system installed was 0.9 kWp, free standing on a concrete walkway with all parameters monitored in high resolution data, in five-minute intervals, for the duration of two consecutive years. The field datasets were analyzed and evaluated using established standards and guidelines: MS IEC 61724:2010 and IEA-PVPS Task 2. Analytical work on the performance revealed that the system showed a very high energy yield, final PV system yield and performance ratio at 3.05 kWh/d, 3.39 kWh/kWp.d, and 81%, respectively under the Af climate region. In this work, a new procedure and technique to assess the stabilization stages of the SJ TFPV modules has been discovered, whilst determining the stabilization period. This new P-G technique involved four steps: (i) prediction DC powers based Initial and Stabilized condition, (ii) linear correlation approach (LCA), (iii) outdoor's validation field-test condition, and (iv) comparison results between the two types of the stabilization period (SP) conditions. The process of the stabilization period has been revealed that requires up to 16 months of operation to achieve fully stable performance under this climatic condition. In addition, in this study, a new technique and concepts in matching TF derating factor as the optimal Inverter-to-Array Power (IAP) ratio has been established for this kind of climate. The new proposed IAP ratio lies within the range of 0.85 – 1.07. These new information have direct impact on all systems design of GCPV using SJ TFPV modules in Malaysia and similar climate region. Furthermore, this will assist the players of PV industry from aspects technical as well as economic for assurance of technology sustainability in solar PV application.