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ABSTRACT

Globally, the partial shading phenomenon has been identified as one of the major issues relating to the successful and effective operation of photovoltaic (PV) plants. The Partial shading may be due to neighboring structures, passing mists, fowls or winged animals litter, etc. will certainly affect the maximum power output of PV power plants. This thesis presents techniques to extract instantaneous maximum power from PV array operating under partial shading conditions (PSCs). The effect of shading patterns on PV array various electrical connection schemes are investigated for achieving maximum power. The work carried out aims to maximize the instantaneous power available at the terminals of PV array under partial shading conditions through an effective PV model, array configuration, reconfiguration and by dispersing the effect of severe shading on the complete PV array.

The work proposes an improved fixed structuring technique to configure the panels in the PV array so that optimum power output can be achieved under partial shading conditions. The technique enables the structure to redistribute shading effect on complete PV array by using panel physical positions alternatively. The PV modules are connected in TCT configuration and the TCT configured array is structured based on ODD-EVEN pattern. Which does not

alter electrical connections of TCT connected PV array. The performance of the proposed structure of PV array is investigated under various shading conditions. The technique is very effective and enables to get an appreciably improved power generation of PV array. Also it, disperse the effect of severe shading over the entire array and thereby minimizing the mismatch losses. The number of rows and columns in a PV array is decided by the level of current and voltage required to feed the load. The proposed technique can be used to design a PV array structure for any number of rows and columns; symmetrical or asymmetrical. The technique mitigates the occurrence of multiple local maxima and thus avoids the necessity of complex maximum power point tracking algorithm. The simple and cost-effective PV array structure is the additional merit associated with this configuration. The power production of partially shaded PV array can significantly be increased by suitably selecting PV array configuration and reconfiguration scheme. This work presents a comprehensive study of various PV array configurations and reconfiguration under partial shading conditions. The performance in terms of maximum power output, shading losses, mismatch losses and fill factor of PV array configuration that is; Total Cross Tied (TCT), Series-Parallel (SP), Bridge-linked (BL), Honey Comb (HC) and reconfiguration namely; Odd-Even (OE) are evaluated for different case studies. The results are compared with those of 7×7 PV array configuration for the same shading conditions. The outcomes exhibit that OE reconfiguration provides improved performance in terms of maximum power for all considered shading condition.