World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:12, No:08, 2018

Analysis of Grid Connected High Concentrated Photovoltaic Systems for Peak Load Shaving in Kuwait

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Abstract : Air conditioning devices are substantially utilized in the summer months, as a result maximum loads in Kuwait take place in these intervals. Peak energy consumption are usually more expensive to satisfy compared to other standard power sources. The primary objective of the current work is to enhance the performance of high concentrated photovoltaic (HCPV) systems in an attempt to minimize peak power usage in Kuwait using HCPV modules. High concentrated PV multi-junction solar cells provide a promising method towards accomplishing lowest pricing per kilowatt-hour. Nevertheless, these cells have various features that should be resolved to be feasible for extensive power production. A single diode equivalent circuit model is formulated to analyze multi-junction solar cells efficiency in Kuwait weather circumstances taking into account the effects of both the temperature and the concentration ratio. The diode shunt resistance that is commonly ignored in the established models is considered in the present numerical model. The current model results are successfully validated versus measurements from published data to within 1.8% accuracy. Present calculations reveal that the single diode model considering the shunt resistance provides accurate and dependable results. The electrical efficiency (η) is observed to increase with concentration to a specific concentration level after which it reduces. Implementing grid systems is noticed to increase with concentration to a certain concentration degree after which it decreases. Employing grid connected HCPV systems results in significant peak load reduction.

Keywords : grid connected, high concentrated photovoltaic systems, peak load, solar cells
Conference Title : ICETCR 2018 : International Conference on Energy Technologies and Coal Reserves
Conference Location : New York, United States
Conference Dates : August 27-28, 2018