2012 SATU Joint Research Scheme	
NCKU Project Host Center	Advanced Optoelectronic Technology Center
Project Title	Photovoltaic Power System
NCKU PI	PI: Prof. Tsorng-Juu Liang, Dept. of Electrical Engineering, NCKU
Foreign Co-PI	Prof. Abd Rahim Nasrudin / Prof. Hew Wooi Ping, University of Malaya Prof. Mekhilef Saad, Abd Rahim Nasrudin, University of Malaya
Date	2012/10/11
Venue	B1, Lin-Yang Room, Building of EE Dept., NCKU

Objectives

The objective of the collaborative research is to develop a high efficiency photovoltaic energy conversion system. NCKU PI, Prof. Tsorng-Juu Liang, proposed a high step dc-dc converter with very high efficiency for micro-inverter. The foreign Co-PI, Prof. Abd Rahim Nasrudin and Prof. Hew Wooi Ping, developed a monitoring system to improve the performance of the photovoltaic power system in tropical countries. Prof. Mekhilef Saad proposed a project focusing on the improvement of maximum power point tracking (MPPT) methods for photovoltaic (PV) systems using a modified particle swarm optimization (PSO) algorithm and incremental conductance method.

Collaborative Strategy

The typical PV inverter proposed in this research is the front stage of the micro-inverter (or DC Distribute System) –high step dc-dc converter with maximum power tracking function. The dc-dc converter proposed by the NCKU PI is a high step up dc-dc converter that uses the coupling inductor and switching capacitor technology. Thus, this converter can convert the PV output voltage (28~40V) to a very high voltage (400V) and the maximum efficiency of this converter is 96%. Prof. Abd Rahim Nasrudin and Prof. Hew Wooi Ping proposed a cooling system to reduce the temperature of PV module and thus improving the photovoltaic conversion efficiency and also the system reliability. Prof. Mekhilef Saad proposed a novel maximum power tracking algorithm by combining the main advantage of the modified particle swarm optimization (PSO) algorithm with the incremental conductance method. The proposed MPPT method can reduce the steady state oscillation (to practically zero) once the maximum power point (MPP) is located. In addition, the extreme environmental condition, e.g. large fluctuations of insolation and partial shading conditions will be taken into consideration. Finally, dc-dc converter with maximum circuit efficiency and maximum power tracking efficiency is realized.

Employing technologies are developed in NCKU and Taiwan to monitor performance of photovoltaic system in Malaysia. Students and staffs are exchanged between NCKU AOTC and UMPEDAC.

Future Perspectives

The high efficiency PV energy will be realized. The micro-inverter (or DC Distribute System) will be constructed with a high step up dc-dc converter, a modified maximum power tracking algorithm, a dc-ac inverter to convert the DC voltage to a line frequency ac output and supply energy to utility grid system. In addition, the islanding function will be implemented for protecting the system. The maximum power tracking can be achieved and the shading effect of the PV system can be avoided. The maximum system efficiency can achieve 95% and the maximum power tracking efficiency is 99%. In addition, new standard and technologies suitable for photovoltaic power system in the tropical countries will be developed to improve performance and better reliability.