

Inverter for grid-connected photovoltaic system

UNIVERSITY of Malaya, through its centre UM Power Energy Dedicated Advanced Centre (UMPEDEC), was awarded RM2.4 million for five years (2005-2010) with a task to develop local inverter products for market commercialisation.

In this project, single-phase grid-connected with transformer and transformer-less photovoltaic inverter will be proposed and were designed in different inverter topology.

Twelve prototypes of single-phase grid-connected photovoltaic inverters with powers ranging from low: 300W to high: 3.4kW were produced.

Of 12 prototypes, four were tested to AS4777.2-2005, AS4777.3-2005, and IEC 61683:1999 standards, at Inverter Quality Control Centre.

"The prototypes passed all the tests, their performance in some surpassing expectations," said UM Prof Dr Nasrudin Abd Rahim.

He said a 2.0kW single-phase grid-connected inverter has been installed in a demo-house situated in a cluster of houses in Section 24, Shah Alam.

A direct-feed system installed comprises eighteen Suntech polycrystalline (STP120-24/AC) panels and a 2.0kW single-phase grid-connected photovoltaic inverter with transformer.

System monitoring and control are also installed, monitoring reliable functioning of the inverter system and maximum yield of the solar electric system.

Prof Nasrudin said the MBIPV research groups are developing a monitoring station that will remote-monitor, and read, parameters such as AC power, DC power, solar irradiation, PV array power and temperature.

"String inverter concept was used in which PV string arrays are connected to inverter in the power range (1-3) kW, to feed energy into the AC grid in a parallel configuration.

"All developed products are designed for residential application and suitable for local conditions," he said.

Prof Nasrudin said in this proposed project, inverter technologies that will be applied are single-phase grid-connected inverter topology with digital PI current



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control, single-phase grid-connected transformer-less photovoltaic inverter with digital PI current control; and single-phase multi-level inverter topology.

He said this developed research products presents a novel PWM control scheme where two reference signals and a carrier signal are used to generate the PWM switching signals.

The MBIPV project produced a patent and products, and won an award.

The patent is copyright for "Multi-

String Multi-Level for Single-Phase Grid-Connected Photovoltaic System", a single-phase multi-string five-level inverter topology for grid-connected photovoltaic systems with a novel PWM control scheme.

Prof Nasrudin said the UM research groups are also capable of producing related products such as solar-panel simulator and photovoltaic maximum power point tracking monitoring system.

"The photovoltaic maximum power point tracking monitoring system

product won bronze at the International Invention, Innovation and Technology Exhibition," he said.

He said developed prototype is now in the process of commercialisation with industrial partner — a Bumiputera company, EXT Technologies Sdn Bhd.

Prof Nasrudin said the product has vast market potential as the world market for PV inverters revealed huge demand for inverters.

According to the new IMS Research Report; the global PV inverter market is forecast to reach US\$8.5 billion (RM26.60 billion) by 2014, growing at compound annual growth rate of nearly 25 per cent.

The report revealed that more than seven million inverters will be sold in 2014, up from less than one million in 2009.

He said it also found that, despite a factory-gate price decline of around 11 per cent in 2010, revenues generated from PV inverters more than doubled, and exceeded US\$5 billion for the first time.

"In the long-term, positive growth is predicted to continue, despite on-going price reductions and architecture changes, and the market will double in size again in the next five years," he said.