

Impact of Solar Irradiance and Ambient Temperature on PV Inverter Reliability Considering Geographical Locations

Abstract:

Today inverter system is one of the enabling technologies for efficiently harnessing energy from renewable energy sources (Solar, Wind, etc.,) and also for high reliable grid interfacing systems. With the advancements in power electronics, inverter conversion efficiency pushed to 98%, also PV is becoming a major renewable energy source globally. Nevertheless, the reliability performance of PV inverter is of high concern. Different environmental factors like solar irradiance, ambient temperature (also called Mission Profile) affect the reliability performance of PV inverter. Environmental conditions vary from location to location. Hence to quantify the reliability performance of PV inverter all these factors need to be considered. In this paper reliability performance of PV inverter is evaluated considering environmental factors and geographical locations. For the reliability evaluation, a 1- ϕ , 3-kW grid connected PV system is developed in PLECS. Full bridge PV inverter with 600V/30A IGBT is employed as the interface between grid and PV source. Real time mission profile data of one-year logs at India (Relatively hot climate) and Denmark (Relatively cold climate) to account for environmental factors and geographical locations during the reliability performance evaluation of PV inverter. Monte Carlo simulation is used to generate a population of 20000 samples with 5% variation. Lifetime for 20000 samples is calculated and fitted in Two Parameter Weibull distribution. B10 lifetime is calculated at two locations. The results of this paper reveal that environmental factors and geographical locations have a significant impact on PV inverter reliability performance.