



Solar PV Systems-Challenges and Requirements, 3h

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Abstract

Grid-connected photovoltaic (PV) systems are one of the fastest growing renewable energy conversion systems in the world. In fact it has increased more than 7 times in the in recent past (from 5.4GW to 40GW of installed capacity). The main reason for this remarkable development is the cost reduction of PV modules and the introduction of economic incentives or subsidies due to growing environmental concerns. This has made PV generated electrical energy cost-effective and competitive in some regions of the world with good sun radiation conditions. Projections show that PV technology costs will continue declining in the next decade, making large-scale PV systems more and more attractive. Only a couple of years ago, the largest PV plant was of 20 MW installed capacity. Today, the largest PV farm is of more than 500MW. The largest PV systems currently under operation are several in numbers. It can be concluded that large-scale PV farms are in the megawatt range, which is considered high power in the power converter industry. Furthermore, there are several PV plants over 500 MW each currently under development, and China has even announced a 2GW PV project in the Mongolian Desert. India is also a leading country with ambitious plan of expansion of Multimega watt Solar PV plants. Power electronics, used as an interface between the PV generation sources and the electricity grid play an important role in facilitating an efficient and optimal energy transfer, as well as increasing system reliability and utilizing an economically viable solution. However, despite the clear trend in the increase of power rating of PV plants, power converter interfaces for large-scale PV systems have not evolved much and are concentrated in a couple of system configurations and converter topologies. The lecture will cover the present state of the art in renewable energy sources emphasizing on solar PV system. The basic terminologies associated with the solar

energy system will be discussed. The basic characteristics of solar PV system will be discusses. The modeling and control approach will be elaborated. The talk will also focus on the existing inverter topologies, their classifications and operations. The control of grid connected inverters and synchronization requirements will be discusses. The present challenges and requirements related to grid-connected inverters will be presented. The future directions will also be given.