Power Electronics for Photovoltaic Power Systems

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ISBN: 978-3-031-01372-0 paperback
ISBN: 978-3-031-02500-6 ebook

DOI 10.1007/978-3-031-02500-6

A Publication in the Springer series
SYNTHESIS LECTURES ON POWER ELECTRONICS

Lecture #8
Series Editor: Jerry Hudgins, *University of Nebraska-Lincoln*
Series ISSN
Print 1931-9525 Electronic 1931-9533

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SYNTHESIS LECTURES ON POWER ELECTRONICS #8

ABSTRACT

The world energy demand has been increasing in a rapid manner with the increase of population and rising standard of living. The world population has nearly doubled in the last 40 years from 3.7 billion people to the present 7 billion people. It is anticipated that world population will grow towards 8 billion around 2030. Furthermore, the conventional fossil fuel supplies become unsustainable as the energy demand in emerging big economies such as China and India would rise tremendously where the China will increase its energy demand by 75% and India by 100% in the next 25 years. With dwindling natural resources, many countries throughout the world have increasingly invested in renewable resources such as photovoltaics (PV) and wind.

The world has seen immense growth in global photovoltaic power generation over the last few decades. For example, in Australia, renewable resources represented nearly 15% of total power generation in 2013. Among renewable resources, solar and wind account for 38% of generation. In near future, energy in the domestic and industrial sector will become "ubiquitous" where consumers would have multiple sources to get their energy. Another such prediction is that co-location of solar and electrical storage will see a rapid growth in global domestic and industrial sectors; conventional power companies, which dominate the electricity market, will face increasing challenges in maintaining their incumbent business models.

The efficiency, reliability and cost-effectiveness of the power converters used to interface PV panels to the mains grid and other types of off-grid loads are of major concern in the process of system design. This book describes state-of-the-art power electronic converter topologies used in various PV power conversion schemes. This book aims to provide a reader with a wide variety of topologies applied in different circumstances so that the reader would be able to make an educated choice for a given application.

KEYWORDS

active power decoupling, centralized PV power conversion, distributed PV power conversion, energy storage interfacing, isolated DC-DC converters, multi-level converters, non-isolated DC-DC converters, photovoltaic power systems, power converter control, power electronics, soft-switching, micro inverters, micro converters, module integrated converters

Contents