Solar photovoltaic (PV) technology has been successfully implemented in the remote regions of India for more than two decades now. It has various end-use applications like lighting, pumping water, and charging battery for multiple uses. However, recently, there has been a growing bias towards the use of PV grid connected power plants. The larger issue here is that of tracing a connection between solar energy and grid connectivity. Solar energy is available during the day, while the grid power is available both during the day and night. The solar system component engineering drives the feeding of solar power into the locally available grid, but not without a wide range of challenges involved. Various countrywide initiatives like the Jawaharlal Nehru National Solar Mission have emerged. At the same time, grid power related initiatives have been undertaken in countries like Germany, Spain, and the United States.

This book provides an insight into the basic understanding of PV grid power plants from various end-use considerations. It also touches upon the policy, planning, marketing, and financing aspects vis-à-vis the performance indicators attained by different countries in the world. Various facets of solar power generation have been explored, which makes this publication an important intervention in the field of solar PV.
SOLAR PV POWER
A Global Perspective

Suneel Deambi

The Energy and Resources Institute
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Published by
TERI Press
The Energy and Resources Institute
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003
India

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Printed in India
Foreword

Solar-based energy technologies are part of the future of energy supply when developments are likely to be quite revolutionary. The sudden crash of oil prices in 1985 clearly set back efforts in research and development (R&D) to come up with cost-effective and efficient methods for converting solar energy into electricity. In recent years, oil prices have gone up, and in addition, concerns related to reduction in emissions of greenhouse gases have certainly revived interest in innovation by which a quantum jump can be achieved by improving the efficiency and cost-effectiveness of photovoltaic (PV) cells. But, of course, global efforts in R&D are still very meagre, and unlikely to result in substantial changes in the economy of PV-based grid power in the near future.

This book presents an extremely useful overview of the status of PV technology and its rapidly changing prospects in the future. The contents consist of an assessment of the current status of the international solar PV programme and applications related to the supply of electricity using solar PV through the grid. This is an area which is characterized by several complexities related to not only the technologies employed for producing PV power supply, but also policy issues and pricing regimes that are an important part of PV-based grid power. As far as India is concerned, the developments in this area have so far been less than strategic in nature and somewhat jerky in implementation. For the full potential of solar PV grid power to be harnessed on an optimal scale, a dynamic policy regime needs to be constructed so that not only can solar PV be harnessed substantially in the short term but also an enlightened policy focused on the future can provide adequate incentives for rapid development of technology and its applications.

Overall, solar PV grid power has enormous potential, which can at best be delayed but can no longer be denied. There is in evidence today a lack of proper understanding regarding this technology and the benefits that it could provide. A book of this nature would certainly provide a very useful basis for creating adequate understanding of where we are in this promising field and where we should be in the coming years.
The mismatch between policy and performance is brought out starkly by the situation existing not only in India but also in a country like China, which now has the largest installed manufacturing capacity for solar panels. Both in the case of China and India, the bulk of solar panels produced are being exported to countries like Germany, which have proactive policies for supply of PV-based power to the grid. Investments in both China and India have, therefore, preceded policies that might develop a market for panels manufactured for their own use. There has not been adequate effort to bring about a quantum jump in technology for improving efficiency and reducing costs through sustained R&D efforts. But there is now hope that some of these actions will take place with the launch of the National Solar Mission, which has ambitious targets and visionary plans for the future. Since we are embarking on a new era of solar energy development in this country, a book of this nature has enormous value in informing not only the public at large but potential manufacturers and entrepreneurs as well as policy-makers, who would be associated with the implementation of the National Solar Mission. In the context of future developments in the field of PV grid power in India, this publication, therefore, acquires substantial value.

R K Pachauri
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Solar photovoltaic (PV) technologies have steadily caught the interest of millions of people worldwide for a variety of reasons. The Indian PV programme is no longer regarded as an off-grid mechanism for meeting just the modest power needs in desolate surroundings. It is more than true that its real evolution has come through a series of innovative policy, planning, and programme implementation measures adopted from time to time, primarily by the Ministry of New and Renewable Energy (MNRE). Technology developers have, on their part, assimilated the best available practices, procedures, and tools to make available successfully performing products and systems. This is not to do away with the logical interpretation and capacity building initiatives towards reaping the best possible gains from this fast emerging technology. There are a few grey areas too, which still merit attention of various stakeholders so as to reinforce the will to succeed. After all, till not long back, several cross-sections of people simply thought of PV technology as something to be doled out for free, as it was considered beyond the normal purchasing capacity of the majority. There has been a shift in attitude now as the rural populace prefers PV lighting systems on easy financing terms, especially due to the adverse effects of oil-based lamps. In cumulative terms, PV technology is now pushing itself for a quite expanded use, foremost being the grid-connected mode of solar power.

PV grid connected systems offer a wide range of both technological and commercial challenges, more so in India, which has just started a major initiative in this direction under the auspices of Jawaharlal Nehru National Solar Mission. The die has been cast in the favour of establishing a cumulative capacity of about 20 GW of solar grid power in the country. The component engineering, assembly, testing, installation, commissioning, and importantly, operation and maintenance issues are to be considered more seriously so as to maintain the faith and confidence of the potential project developers drawn mostly from the brick and mortar sector. Seemingly, hand-holding, at least in the initial stages, is quite vital to realize the long-term objectives of this massive programme in a holistic manner.
Expectedly, solar power may well become an important pillar of the future Indian power supply and gain prominence due to its contribution in realizing a sustainable and carbon free society. Currently, several international organizations and manufacturers alike are vying for the Indian PV grid power market, which offers huge opportunities. There are increased awareness generation activities in terms of seminars, workshops, and think-tank deliberations, with the industry chambers of trade and commerce too coming forward to stimulate a healthy market growth of this hitherto largely subdued programme segment. It is also time to take an account of the weak links, which need to be strengthened in a timely and effective manner by the renewable energy community and PV groups. Information dissemination initiatives are no less important if we are keen on educating different segments of people, in less cumbersome terms, on what PV grid power means and what are its accompanying gains.

The book looks through the paradigm of conventional power sources and their key attributes of availability and use. It also touches upon several elements of solar PV grid power across different frontiers like, for example, technology, applications, industry strength, market, and importantly, the financing aspects. The book comprises seven chapters, each with a varying interface of facts, figures, practices, and trends, which have been represented in an easy-to-understand manner. Sufficient care has been to taken to draw upon the rich experiences of PV grid connected power use in select few countries of the world. The clear intention is to offer some scope for replication within the framework of a new PV grid power programme in the country.

To conclude, this book is expected to serve as a reference source of information on the grid linkage aspects of abundantly available solar power.
Acknowledgements

At the outset, I acknowledge the support of diverse information resource base comprising a large number of solar energy based academic and research organizations, manufacturing entities, industry associations, testing-cum-certification centres, power utilities, policy, planning and financing institutions, and non-governmental organisations. Without their support, it would have been difficult to put together this information in an updated form.

I express my gratitude to TERI Press, which encouraged me to work on this topical subject of growing importance, more so in the backdrop of the just initiated National Solar Mission. I also thank TERI Press for giving final shape to this book.

Finally, I would like to thank my little daughter Tammana, whose smiles kept my zeal to complete this project intact.
Solar PV Power: a global perspective

Publisher: TERI Press
ISBN: 9788179933893
Author: Suneel Deambi

Type the URL: http://www.kopykitab.com/product/8507

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