

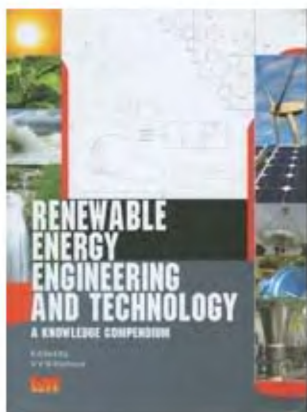
BOOK REVIEWS

theoretical understandings. But it lacks detailed discussion on the preparation of materials, their characterization and hands-on training on applications of superconductors. The organization of the book is ambiguous. Although Appendix 1 is placed at the end of the book, other Appendices (such that 2.1, 3.1, etc.) are inserted at the end of the respective chapters. The get-up of the book is acceptable, but it would have been better if typographical errors and mismatch of references with text were avoided. On p. 8 the initials of Bednorz and Müller have been interchanged.

The authors and the publisher have come out with this useful monograph, which will go a long way enriching our knowledge on both low- and high- T_c superconductivity and solve a long-felt need of a comprehensive treatise on the subject published in India.

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Renewable Energy Engineering and Technology: A Knowledge Compendium. V. V. N. Kishore (ed.). TERI Press, The Energy and Resource Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi 110 003. 2008. 925 pp. Price: Rs 2250.

This is a book long overdue and published just in time. It marks the coming of age of renewable energy technologies as a properly accredited technical discipline in India in its own right. We have an excellent textbook on the basics by Sukhatme, but all subsequent books have

been neither textbooks nor reference books, but somewhere in between just by default. This book is a reference for graduate self-study and a handbook for practising engineers, as it is written primarily by researcher-designers and not by academic teachers. The first two introductory chapters should have been combined into one, with Chapter 2 as a section in Chapter 1, because it is too small to be a chapter by itself.

Many areas of science and technology contribute to renewable energy and thus there is a sizeable chapter on fundamentals after the introductory chapters. The section on photosynthesis should have also been transferred from the chapter on biomass to this chapter. This has been culled from many disciplines to provide a ready reference at hand. It is the reviewer's opinion that all the data along with dimensionless numbers (not included currently) should be grouped separately at the end as a reference appendix for ease of frequent use. There is considerable attention given to systems sizing and integration with balance of system components, which are usually 40% of the total cost, and are the weakest link in India. In 12 chapters, almost all the topics of renewable energy technology and engineering have been considered at reasonable levels of depth and sweep, but with different degrees of detail amongst the resources as applied.

Solar energy is covered in four chapters namely 'Resource', 'Photovoltaic', 'Thermal engineering' and 'Solar buildings'. The chapter on resource is adequate for application, but does not mention the latest estimating models for radiation, commonly discussed in research publications. An additional paragraph may have helped. Also, there should have been a reference to the WMO website, which includes data for 1300 stations around the world. The monthly mean global radiation isopleths of the Indian subcontinent could be useful for initial design stage only. The chapter on photovoltaics is exhaustive. From the point of view of applications, it has too much of details about manufacturing and too little about sizing. There should have been a fully solved example with multipliers for array and battery capacities for specified loss of load probability. A brief section on grid-interfaced solar PV systems and specific issues of building integrated PV would make the chapter more useful. The editor may like to consider this shift in

emphasis for the second edition. Net energy generation over life time with current technology should be brought out explicitly, as this has been a major distracting factor in the past. The chapter on thermal engineering is easily the best, as this is the most mature technology. Integrated presentation of basics and application has worked out well for solar water heating, solar cooking and solar pond, but solar desalination, solar drying and solar power generation are missing altogether. This needs to be looked at, though there are other books available for such applications. Passive solar architecture with respect to different climatic zones of the country can be a perennial source of energy conservation without sacrificing adaptive comfort, which is healthier and takes into account body weight, age, clothing and acclimatization, as formulated by Fanger and later by Humphery and Nicol. A succinct and non-mathematical account is given for passive heating, and cooling for composite climate. The subject is too vast to be covered in a chapter, but a selective list of references would enable a student or designer to use various quantitative design techniques. These are available as computer-coded algorithms, which are gradually being used in India. However, the physics of these systems given in this chapter, is a must background for doing calculations with understanding.

Four chapters have been devoted to other sources of energy, which are more decisively site-specific, namely 'Wind energy', 'Small Hydro', 'Geo and Ocean Thermal Energy' and 'Energy from Waves and Tides'. As for wind resources, these have been mapped in great detail at heights of 10, 25 and 50 m, the latter for power generation. Threshold density of wind energy is 200 W/m^2 for feasibility studies for the type and size of wind generators currently employed in India on large scale (India is fourth in the world in wind energy utilization and fifth in manufacturing). This chapter covers all the methods of analysis, including Weibull distribution. The chapter on wind turbines is preceded by Enercon data sheets (which look like an advertisement rather than part of the data sheets for all the wind machines in use) and this is rather unfortunate in a book of this kind. This chapter is excellent, but does not show how to choose the machines or design a wind farm, starting with available wind data and whether one should have a wind

farm at all. The chapter on Hydro power is a compact one, but has all data on the selection of turbines in relation to the available head. Resources data are included for all the hilly regions, mapped by UNDP-GEF Hilly Hydro project. The chapter on energy from geo and ocean heat or from tides and waves is rather small (included for the sake of completeness) and is based on Open University (OE) notes on renewable sources. Essential characteristics for viability of a geothermal site are stated clearly and explicitly. Ocean thermal energy source mentions both open cycle and closed cycle development. It also mentions the recently discovered phenomenon of mist lift, which dispenses with huge pumps in the marine environment.

Bioenergy sources have also been given in four chapters: 'Resource', 'Wood stoves', 'Biogas', 'Gasifiers and bio-fuels'. Biomass, particularly from crop residues and agro wastes can be a reliable source, as it is readily available like commercial fuel. It can be made carbon neutral, if sufficient plantations are pro-

grammed diligently. The chapter on biomass resources is one of the best the reviewer has come across in renewable energy literature. It describes at length, characterization of biomass, the relevant properties, testing standards and procedures and surplus availability as well as petro trees yielding bio-oil, which can be a substitute for diesel after straining, de-gumming and reduction of viscosity. Thermo-chemical conversion touches upon combustion, pyrolysis, fermentation and liquefaction apart from gasification and densification for feed-handling in terms of size, ash content, moisture content and transportation to plant. Design and testing of wood stoves and gasifiers have been given in detail. Biochemical methods deal with liquid as well as solid wastes from plant and animal sources and delineate aerobic as well as anaerobic processes with sufficient microbial physiology and ecology, to develop a picture of what goes on. These are not explicitly required for operation. Bio-fuels are discussed in the category of non-edible vegetable oils and alcohols,

such as ethanol and methanol, which are specially important for transportation. Energy and environmental impact of bio-residues are, however, not discussed. Unless whole biomass systems are in vogue, bio-fuels will be too costly by themselves.

The book is unique, comprehensive and timely for India and other developing countries. It has an excellent format and is printed on recycled, good-quality paper with clear diagrams, is free from errors (except p. 358 and 451) and has an index. Even though the price is reasonable for a hard-bound book of 940 pages, a cheaper paper-back edition at half the price should be made available to enable more students to own a copy. It would be worthwhile for all libraries and researchers in the field to have a copy of this timely publication.

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