Planning and installing photovoltaic system: a guide for installers, architects and engineers

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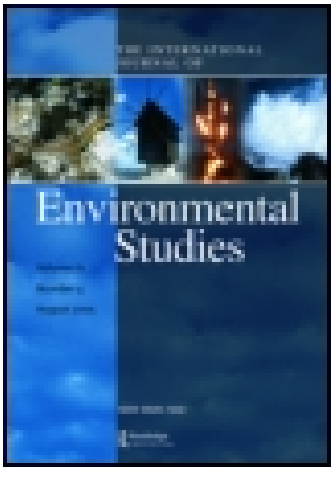

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Book review

Planning and installing photovoltaic system: a guide for installers, architects and engineers, by Deutsche Gesellschaft für Sonnenenergie (DGS), Routledge, Oxfordshire, 2013, 3rd Edition, 524 pp., US $195.00, hbk (ISBN 978-1-84971-343-6).

Life on earth is heliocentric as most of its energy is derived from the sun. Climate change and the demand for clean energy sources have aroused global interest in solar energy: the cleanest and most abundant renewable energy source available. Photovoltaic technology is a major sustainable means to produce electrical energy. Photovoltaic (PV), like any solar technology, offers an opportunity to exploit the dispersed nature of solar energy and to create a spatially distributed system for electricity production. PV power plants are being increasingly used around the world. There is a need for a manual for successful installation of PV panels. This book fulfils it. The 10 chapters provide details for everything necessary for success in the task of installing a PV system, including legal and marketing questions.

Photovoltaics started in 1839, but a new range of possibilities emerged in 1954 when Bell laboratories created the silicon solar cell. The light absorption capacity of silicon is low, yet it is the most sought after material for preparing a solar cell, because it is the second most abundant element on earth after oxygen. Solar cells are available with efficiency ranging from 10 to 20 per cent. The efficiency is determined by the position of the PV module. Any kind of shading, whether direct (antenna, adjacent tall building) or self-shading, can reduce the annual yield of a PV module between 5 and 10% (p. 173). Therefore, detailed shading analysis, manual or digital, needs to be done before installing a PV module. Besides shading, factors like location and month, deviation from horizontal, and ambient temperature can influence the solar irradiance. Solar irradiance, which is the power generated from incident solar radiation per unit area on the earth's surface, directly controls the amount of electricity generated by a PV module. For example, if the temperature of a PV array increases relative to the ambient temperature, that would reduce the energy yield of that particular PV array. The highest energy yield of a PV array is attained when there is optimum inclination. If the data about these controlling factors are available, a yield forecast of a PV array is possible using computer simulation programs.

Accuracy of any forecast depends upon the programming method used in the programme. Calculation Programs like NSol! and PV-kalk, mainly based on statistical methods, are application oriented and deliver quick results. On the other hand, time-step simulation programs, such as Archelios Pro and DASTPVPS, use models to predict systems' behaviour based on time series of meteorological input data. Time-step simulation programs are considerably more flexible than calculation programs (p. 309). Apart from these paid stand-alone programs, there are some web-based simulation programs available, e.g. PV-professional and PV scout.

PV panels can be installed on the roof of a single household for its own consumption or an array can be mounted on ground. In each case, the process of installation, including

choice of cables, junction box, inverters and protective devices, will be different. The book provides a model checklist that any PV installer needs to prepare before a client meeting. Besides specific details, the book provides some general guidelines also. For example, an area of 8 m^2 is needed to generate 1 kWp solar PV power (p. 193); the inclination angle of a PV module should be latitude of that area plus 15° (p. 277); there should be 1-m walking space available between or around a solar array so that fire-fighters can enter the house through roofs (p. 251). These useful points can help a non-technical person as well as a practitioner.

The book introduces building-integrated photovoltaics (BIPV) where PV modules are 'building material that additionally produces electricity'. According to this concept, building components of the roof or façade are replaced with photovoltaic components (p. 337). When major parts of buildings are covered with PV modules, installation solutions need to be visually pleasing. This requires modules with diverse appearances and functional qualities for different buildings (p. 88). The PV market offers a broad range of design options, including glass type/size, cell type/coverage/shape, etc. The strong growth of the PV market in the last decade is a result of significant cost reduction for this technology (p. 477). Since the modules of a PV system account for two-thirds of the initial investment cost, price reduction of solar cells has a strong impact on power generation costs, and thus also the cost to the customer.

This is a comprehensive book, providing all the information needed to architects and engineers interested in installing PV panels. Although the focus is on actual installation procedure, sections on solar irradiance, types of solar cell and the environmental effect of solar cells can be useful for researchers in this field. The book has tried to bring together every possible issue with PV panels, and therefore in some places, loses its focus. For example, detailed discussion on functioning of different types of solar cell seems redundant. The chapter on simulation programs available for yield forecasting seems unnecessarily lengthy. A couple of examples on available programs would have served the purpose. Prior technical knowledge is a prerequisite to understanding most of this book, specifically the sections on inverter, battery, voltage, cables, wiring and AC and DC coupling.

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