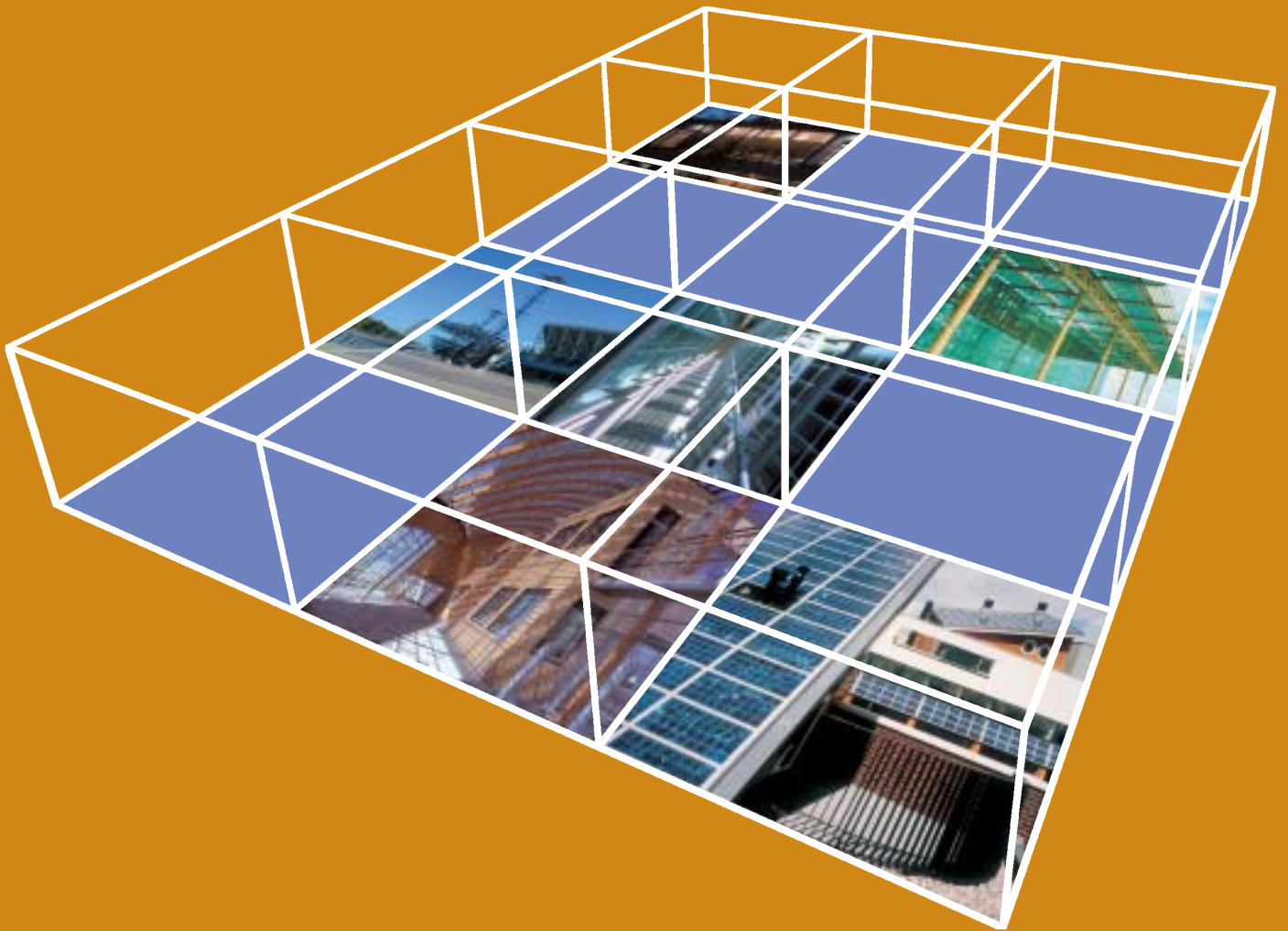


DESIGNING WITH  
**SOLAR POWER**

A SOURCE BOOK FOR BUILDING INTEGRATED PHOTOVOLTAICS (BiPV)

EDITORS DEO PRASAD & MARK SNOW



images  
Publishing

# DESIGNING WITH SOLAR POWER: A SOURCE BOOK FOR BUILDING INTEGRATED PHOTOVOLTAICS (BIPV)

## DESIGNING WITH SOLAR POWER ENCAPSULATES FIVE YEARS OF WORK BY OVER 30 INTERNATIONAL EXPERTS FROM THE FIELDS OF RESEARCH, DEVELOPMENT AND DESIGN.

Photovoltaic (PV) power's potential for wide distribution makes it a unique and novel energy source that can be embedded within the fabric of individual buildings, shifting power generation away from being large scale and regionally located. As a consequence, an abundantly available, clean and silent electrical supply can be introduced into cities, towns and built-up areas.

Building integrated photovoltaics (BiPV) involves combining solar photovoltaic electricity technologies with those of building construction. This subject is of great interest to those in the fields of energy conservation and building design.

Its significance, however cannot be underestimated in the context of the more familiar notion of sustainable development. The concept of sustainability is more relevant than ever: It is a dynamic process that enables all people to realise their potential, and improve their quality of life in ways that simultaneously protect and enhance the Earth's life support systems. BiPV addresses these essential aspects.

In addition to greatly assisting the spread of knowledge of BiPV, it is hoped that *Designing with Solar Power* makes a case for encouraging governments and agencies to support its deployment and raise confidence in its use by architects, engineers, environmentalists, planners and their clients.

## THE INTERNATIONAL ENERGY AGENCY (IEA), PARIS, FRANCE, PHOTOVOLTAIC POWER SYSTEMS PROGRAMME (PVPS), TASK 7, PHOTOVOLTAICS IN THE BUILT ENVIRONMENT

Since 1 January 1997, Task 7 has been active within the International Energy Agency's (IEA) PV Power Systems (PVPS) Program. The key objectives of Task 7 are to enhance the architectural quality, the technical quality and the economic viability of PV systems in the built environment and to assess and remove non-technical barriers for their introduction as an energy-significant option.

IEA PVPS Task 7 is an international collaborative programme, linking PV developments of Europe, the United States, Canada, Japan and Australia to each other. The work in Task 7 builds on previous collaborative actions within the IEA (Task 16 of the Solar Heating and Cooling Program) and concentrates on assisting the long-term development of building integrated PV (BiPV), as well as contributing to short-term market opportunities.

In order to achieve the overall objectives, national experts from the PV industry, architecture, engineering and other specialist fields have worked together in a research and knowledge exchange programme to complete four sub-tasks: architectural design, systems technologies, non-technical barriers and demonstration and dissemination. Each sub-task is co-ordinated by a sub-task leader. The role of the sub-task leaders is to assist the Operating Agent. Activities are performed within each sub-task under primary responsibility of activity leaders.

*Designing with Solar Power* is a deliverable of activity 1.3 under sub-task 1 'Architectural quality' and encapsulates the core outcomes and knowledge resulting from Task 7. All the participants in Task 7 contributed to the knowledge in the book with specific contributions from David Lloyd Jones, Donna Munro (UK), Tony Schoen, Tjerk Reijenga (Netherlands), Steven Strong, Gregory Kiss, Patrina Eiffert (US), Carl Michael Johannesson, Mats Andersson (Sweden), Marcel Gutschner, Stefan Nowak, Daniel Ruoss, Christian Roecker (Switzerland), Henrik Sørensen (Denmark), Jiro Ohno, Tadashi Ito (Japan), Peter Lund (Finland) Hermann Laukamp, Ingo Hagemann (Germany), Cinzia Abbate (Italy) Per Drewes, (Canada), Nuriá Martín Chivelet (Spain), Jongho Yoon (South Korea), Reinhard Haas, Henrich Wilk, Karin Stieldorf (Austria), Deo Prasad and Mark Snow (Australia).

## PRINCIPAL EDITORS

### Professor Deo Prasad

Professor Deo Prasad is the Director of SOLARCH Group: University of NSW Centre for a Sustainable Built Environment, Sydney, Australia. He has qualifications and experience in architecture and engineering and has an international reputation for his work in the field of sustainable buildings. Deo was a sub-task leader of Task 7 in the IEA PVPS program: PV in the Built Environment. He is also a director of the International Solar Energy Society (ISES).

### Dr Mark Snow

Dr Mark Snow is a senior researcher at the SOLARCH Group. His doctorate is in the field of modelling BiPV. Mark consults in this area and has particular interest in urban sustainability research and education.

## BOOK OVERVIEW

### CHAPTER 1 BUILDING DESIGN AND ENVIRONMENTAL CONCEPTS

This chapter discusses the holistic design process and how new technologies are part of the decision-making process. It also explores building aesthetics and urban aesthetics, in addition to functional and performance needs versus architectural appeal of BiPV and other technologies.

### CHAPTER 2 TECHNOLOGIES AND INTEGRATION CONCEPTS

This chapter explores PV technologies in the marketplace and provides a summary of integration concepts in use for all building typologies, commenting on architectural appropriateness as applicable. Cost issues and efficiencies for different systems are also discussed.

### CHAPTER 3 INTERNATIONAL BIPV CASE EXAMPLES

This chapter includes 22 international BiPV case studies. Each case study includes design and development process issues as well as the architectural and technical quality of the projects.

Australia	<i>Sydney Olympics Village</i>
Austria	<i>Energypark West, Satheins</i>
Canada	<i>Ontario Power Generation Head Office, Toronto</i> <i>William Farrell Building, Vancouver</i>
Denmark	<i>Brundtland Centre</i>
Germany	<i>Mont Cenis Academy, Herne-Sodingen</i> <i>Neubau Franhofer ISE, Freiburg</i>
Italy	<i>The Children's Museum of Rome</i>
Japan	<i>NTT DoCoMo, Tokyo</i> <i>SBIC East Building, Tokyo</i> <i>J-House, Tokyo</i>
Netherlands	<i>Nieuwland, Amersfoort,</i> <i>ECN Building 31 and 42, Patten</i> <i>Le Donjon, Gouda</i>
South Korea	<i>Korean Institute of Energy Research SLEB, Taejon</i>
Spain	<i>Univer, Jaén</i>
Switzerland	<i>ABZ Marchwartstr., Zurich</i>
United Kingdom	<i>Doxford Building, Sunderland</i> <i>Jubilee Campus, Nottingham</i>
United States of America	<i>4 Times Square Building, New York</i> <i>Georgia Natatorium swimming pool complex</i> <i>Discovery Science Centre Cube, Santa Ana</i>

### CHAPTER 4 NON-BUILDING STRUCTURES

This chapter includes discussion and examples of non-building structures in the built environment including process and performance issues.

### CHAPTER 5 BIPV POTENTIAL AND TOOLS

The PV potential study covers solar yield considerations and issues for surfaces of building envelopes at a city scale from IEA participating countries and assesses prospective opportunities. This is complemented by a review and analysis of BiPV design tools.

### CHAPTER 6 ELECTRICAL CONCEPTS AND RELIABILITY ISSUES

This chapter reviews technical issues and best practice considerations including detailed consideration of electrical concepts, reliability and standards.



### CHAPTER 7 NON-TECHNICAL BARRIERS AND MARKETS

This chapter overviews marketing and government strategies by country and financing strategies including experiences for BiPV implementation. Also included is a comprehensive discussion of non-technical barriers and opportunities.

## APPENDICES

### TRAINING CD

*Henk Kaan, Bronia Jablonska, Jaap Eikelboom, Prof. W.C. Sinke, Arthur Weeber and Herbert Zondag – ECN, Netherlands*

An interactive CD-ROM-based teaching and training package covering PV fundamentals, system design and building integration concepts.

## BIBLIOGRAPHY

A comprehensive international reference list of PV and BiPV specific literature, websites, product and project databases.



# THE IMAGES PUBLISHING GROUP

*Designing With Solar Power: A Source Book for Building Integrated Photovoltaics (BiPV)*, is The Images Publishing Group's first work dedicated to solar power.

The Images Publishing Group also produces monographs on the world's most prominent architects in their **Master Architect** series (over 60 titles have been published to date); the **International Spaces** series – an inspiring series of pictorial books exploring a variety of spaces; the **House Design** series – featuring innovative residential design by respected architects; the highly regarded **International Architecture Yearbook**; plus an impressive array of other series including **Designing the World's Best**, **Master Landscape Architect**, **Tall Buildings**, **Details in Architecture**, and reference books such as the essential *Twentieth Century Architecture*.

Visit our website at [www.imagespublishinggroup.com](http://www.imagespublishinggroup.com)

## ORDER FORM

### Designing With Solar Power: A Source Book for Building Integrated Photovoltaics (BiPV)

Name: \_\_\_\_\_

Firm/Organisation: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Postcode: \_\_\_\_\_

Country: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Email: \_\_\_\_\_

I wish to order the following: \_\_\_\_\_ copies of the book @ the special pre-publication price of AUD\$72.00\* per copy

**TOTAL PAYMENT DUE:** \_\_\_\_\_

\*This price is inclusive of packaging and delivery in Australia. For all overseas orders please add AUD\$20.00. This price is valid for orders made before 31 December 2002.

### PAYMENT METHOD

Enclosed is my cheque payable to The Images Publishing Group Pty Ltd or

Charge my credit card:  Bankcard  Visa  Mastercard  American Express

Card Number: \_\_\_\_\_ Expiry date: \_\_\_\_\_

Billing Address: \_\_\_\_\_

Cardholder's Name: \_\_\_\_\_

Signature: \_\_\_\_\_

### PLEASE RETURN THIS FORM WITH PAYMENT TO:

The Images Publishing Group Pty Ltd  
6 Bastow Place, Mulgrave, Victoria 3170, Australia

### FOR PREPAID OR CREDIT CARD PAYMENTS

Fax this form to + (613) 9561 4860

images  
Publishing