

# Solar Power Generation

Paul Breeze



AMSTERDAM • BOSTON • HEIDELBERG • LONDON  
NEW YORK • OXFORD • PARIS • SAN DIEGO  
SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Academic Press is an imprint of Elsevier



# CONTENTS

<b>Chapter 1 An Introduction to Solar Power .....</b>	<b>1</b>
The History of Solar Power.....	3
Global Solar Power Generating Capacity.....	5
<b>Chapter 2 The Solar Resource .....</b>	<b>9</b>
Intermittency .....	12
Distribution of Solar Energy .....	14
<b>Chapter 3 Solar Thermal Power Generation .....</b>	<b>17</b>
Global Solar Thermal Potential.....	18
Solar Thermal Technologies .....	19
Unconventional Solar Thermal Technologies.....	20
Solar Collectors .....	21
Energy Storage .....	22
Energy Conversion and Heat Engines .....	23
Electricity Transportation.....	23
<b>Chapter 4 Parabolic Trough and Fresnel Reflector Solar Power Plants .....</b>	<b>25</b>
Line Focusing Origins .....	25
Parabolic Trough Technology .....	26
Fresnel Reflectors .....	29
Power Generation.....	30
Energy Storage .....	31
Commercial Solar Trough Power Plants .....	32
Hybrid Solar Thermal Power Plants.....	33
<b>Chapter 5 Solar Towers.....</b>	<b>35</b>
Solar Tower Technology.....	36
Power Generation.....	38
Air-Driven Systems.....	40

<b>Chapter 6 Solar Dishes.....</b>	<b>41</b>
Solar Dish Technology .....	42
Power Generation in Solar Dish Systems .....	44
Commercial Solar Dish Projects .....	45
<b>Chapter 7 Other Solar Thermal Technologies.....</b>	<b>47</b>
The Solar Chimney .....	47
The Solar Pond.....	49
Solar Pond Schemes.....	50
<b>Chapter 8 Solar Photovoltaic Technologies.....</b>	<b>51</b>
Origins .....	52
Solar Photovoltaic Basics .....	53
<b>Chapter 9 Types of Solar Cells.....</b>	<b>57</b>
Silicon Solar Cells.....	58
Thin Film Solar Cells .....	62
Multilayer Solar Cells.....	64
Enhanced Light Absorption Techniques.....	65
Concentrating Solar Cells .....	66
Third-Generation Solar Cells.....	68
<b>Chapter 10 Modules, Inverters, and Solar Photovoltaic Systems.....</b>	<b>71</b>
Cell and Module Outputs .....	72
Inverters.....	74
Maximum Power Point Tracking .....	76
Grid Interfacing.....	77
Solar Photovoltaic Installations.....	78
<b>Chapter 11 Solar Integration and the Environmental Impact of Solar Power .....</b>	<b>81</b>
The Environmental Impact of Solar Power .....	82
Life Cycle Cost.....	84
Solar Integration.....	85
<b>Chapter 12 The Cost of Solar Power .....</b>	<b>89</b>
Levelized Cost of Energy Model .....	89
The Capital Cost of Solar Power Plants .....	90
The Levelized Cost of Solar Power.....	92