

Making Everything Easier!™

2nd Edition

Solar Power Your Home

FOR
DUMMIES®

Learn to:

- Weigh the pros and cons of powering your home with solar
- Evaluate solar products, projects, and applications
- Apply for government incentives and tax breaks
- Assess the costs and payback potential of a full-scale photovoltaic system

Rik DeGunther

Design engineer and energy-efficiency consultant



Get More and Do More at Dummies.com®



Start with **FREE** Cheat Sheets

Cheat Sheets include

- Checklists
- Charts
- Common Instructions
- And Other Good Stuff!

To access the Cheat Sheet created specifically for this book, go to
www.dummies.com/cheatsheet/solarpoweryourhome

Get Smart at Dummies.com

Dummies.com makes your life easier with 1,000s of answers on everything from removing wallpaper to using the latest version of Windows.

Check out our

- Videos
- Illustrated Articles
- Step-by-Step Instructions

Plus, each month you can win valuable prizes by entering our Dummies.com sweepstakes.*

Want a weekly dose of Dummies? Sign up for Newsletters on

- Digital Photography
- Microsoft Windows & Office
- Personal Finance & Investing
- Health & Wellness
- Computing, iPods & Cell Phones
- eBay
- Internet
- Food, Home & Garden

Find out **“HOW”** at Dummies.com

*Sweepstakes not currently available in all countries; visit Dummies.com for official rules.



Solar Power Your Home

FOR

DUMMIES[®]

2ND EDITION

by Rik DeGunther



WILEY

Wiley Publishing, Inc.

Solar Power Your Home For Dummies®, 2nd Edition

Published by
Wiley Publishing, Inc.
111 River St.
Hoboken, NJ 07030-5774
www.wiley.com

Copyright © 2010 by Wiley Publishing, Inc., Indianapolis, Indiana

Published by Wiley Publishing, Inc., Indianapolis, Indiana

Published simultaneously in Canada

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

Trademarks: Wiley, the Wiley Publishing logo, For Dummies, the Dummies Man logo, A Reference for the Rest of Us!, The Dummies Way, Dummies Daily, The Fun and Easy Way, Dummies.com, Making Everything Easier, and related trade dress are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. Wiley Publishing, Inc., is not associated with any product or vendor mentioned in this book.

LIMIT OF LIABILITY/DISCLAIMER OF WARRANTY: THE PUBLISHER AND THE AUTHOR MAKE NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS WORK AND SPECIFICALLY DISCLAIM ALL WARRANTIES, INCLUDING WITHOUT LIMITATION WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTY MAY BE CREATED OR EXTENDED BY SALES OR PROMOTIONAL MATERIALS. THE ADVICE AND STRATEGIES CONTAINED HEREIN MAY NOT BE SUITABLE FOR EVERY SITUATION. THIS WORK IS SOLD WITH THE UNDERSTANDING THAT THE PUBLISHER IS NOT ENGAGED IN RENDERING LEGAL, ACCOUNTING, OR OTHER PROFESSIONAL SERVICES. IF PROFESSIONAL ASSISTANCE IS REQUIRED, THE SERVICES OF A COMPETENT PROFESSIONAL PERSON SHOULD BE SOUGHT. NEITHER THE PUBLISHER NOR THE AUTHOR SHALL BE LIABLE FOR DAMAGES ARISING HEREFROM. THE FACT THAT AN ORGANIZATION OR WEBSITE IS REFERRED TO IN THIS WORK AS A CITATION AND/OR A POTENTIAL SOURCE OF FURTHER INFORMATION DOES NOT MEAN THAT THE AUTHOR OR THE PUBLISHER ENDORSES THE INFORMATION THE ORGANIZATION OR WEBSITE MAY PROVIDE OR RECOMMENDATIONS IT MAY MAKE. FURTHER, READERS SHOULD BE AWARE THAT INTERNET WEBSITES LISTED IN THIS WORK MAY HAVE CHANGED OR DISAPPEARED BETWEEN WHEN THIS WORK WAS WRITTEN AND WHEN IT IS READ.

For general information on our other products and services, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002.

For technical support, please visit www.wiley.com/techsupport.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Library of Congress Control Number: 2009941925

ISBN: 978-0-470-59678-4

Manufactured in the United States of America. This book is printed on recycled paper

10 9 8 7 6 5 4 3 2 1



About the Author

Rik DeGunther attended the University of Illinois as an undergraduate and Stanford University as a graduate student, studying both applied physics and engineering economics (some of this education actually stuck!). Over the course of an engineering career, he worked as a project engineer, project manager, and product designer. He holds several United States patents and has designed a wide range of technical equipment, including solar power systems, military radar jammers, weather measurement equipment, high-powered vacuum tubes, computerized production hardware, golf practice devices, digital and analog electronic circuits, unmanned aerial vehicles, guitars and amplifiers, microwave systems, explosive devices (strictly by accident), cloud height sensors, fog sensors, furniture, houses, barns, rocket ships, dart throwers, flamethrowers, eavesdropping devices, escape routes, nefarious capers, and you name it. He's one of those nerdy guys who likes to take things apart to see how they work and then put them back together and try to figure out what the leftover parts are for.

Rik is CEO of Efficient Homes, an energy efficiency auditing firm in Northern California. He is actively engaged in designing and developing new solar equipment, including off-grid lighting systems and off-grid swimming pool heaters. He writes weekly op-ed columns for the *Mountain Democrat*, California's oldest and most venerable newspaper. He has also written a golf book (on putting) and spends most of his free time attempting to improve his relatively impressive but objectively droll golf handicap, usually to no avail. Sometimes the urge strikes him to play a very loud guitar, of which he owns a collection with far more intrinsic quality than the playing they receive. His hearing has been faltering the last few years, so he rebuilt his amplifier to go up to 11.

Dedication

Of course, this book is dedicated to Katie, Erik, and Ally. Without them, the sun would not shine at all, and this work of art wouldn't exist.

Author's Acknowledgments

Many thanks to all those who have contributed to the material in this book, whether wittingly or not: Dick and Betty DeGunther, Professor Mitchell Weissbluth, Professor A. J. Fedro, Professor Lamb, John Lennon, Paul McCartney, Leland Stanford, Mike Percy, Jordan Cobb, Eric Micko, Vikki Berenz, Connie Cowan, Betsy Sanders, Jim DeGunther, Sarah Nephew, Freddie Mercury, and Dave and Gary Romano of Sierra Valley Farms. Thanks to Robin Harp (Rik Manes and Reuben Veek) and the crew at Solarecity in Roseville, California, for educating me on the tricks of the solar trade. Thanks to Dr. Keith Kennedy and Watkins-Johnson Company for showing restraint above and beyond the call of duty. And thanks to John Steinbeck for making me understand what's important and what's not, and in the same vein, Derek Madsen.

Thanks to Mike Baker and Tracy Barr from Wiley and to the technical editor Greg Raffio for his excellent and well-received insights and for generously giving his time to this project. And thanks to Stephany Evans at Imprint Agency for getting all the ducks in a row.

Last but not least, thanks to all the *For Dummies* fans out there who have made the series what it is today.

Publisher's Acknowledgments

We're proud of this book; please send us your comments at <http://dummies.custhelp.com>. For other comments, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002.

Some of the people who helped bring this book to market include the following:

Acquisitions, Editorial, and Media Development

Project Editor: Tracy L. Barr
(*Previous Edition: Kelly Ewing*)

Acquisitions Editor: Mike Baker

Copy Editors, Previous Edition:
Danielle Voirol, Vicki Adang

Assistant Editor: Erin Calligan Mooney

Editorial Program Coordinator: Joe Niesen

Technical Editor: Gregory Raffio

Editorial Manager: Jennifer Ehrlich

Editorial Assistant: Jennette ElNaggar

Cover Photos: © iStock

Cartoons: Rich Tennant
(www.the5thwave.com)

Composition Services

Project Coordinator: Katherine Crocker

Layout and Graphics: Joyce Haughey,
Christine Williams

Proofreader: Linda Seifert

Indexer: Potomac Indexing, LLC

Publishing and Editorial for Consumer Dummies

Diane Graves Steele, Vice President and Publisher, Consumer Dummies

Kristin Ferguson-Wagstaffe, Product Development Director, Consumer Dummies

Ensley Eikenburg, Associate Publisher, Travel

Kelly Regan, Editorial Director, Travel

Publishing for Technology Dummies

Andy Cummings, Vice President and Publisher, Dummies Technology/General User

Composition Services

Debbie Stailey, Director of Composition Services

Contents at a Glance

<i>Introduction</i>	1
<i>Part I: Playing the Energy Game</i>	5
Chapter 1: Helping the World through Solar Power.....	7
Chapter 2: Surveying Your Household Energy Efficiency and Use	25
Chapter 3: Making Your Home Energy Efficient.....	45
<i>Part II: Understanding Solar — Just the Facts, Ma'am</i>	65
Chapter 4: Working with Solar Basics	67
Chapter 5: Evaluating Your Solar Potential.....	81
Chapter 6: Calculating Payback on Your Solar Investment.....	93
Chapter 7: Installing Your Solar System	111
<i>Part III: Applications Aplenty: Projects from Small to Large</i>	119
Chapter 8: Digging In to Landscape Projects	121
Chapter 9: Jumping In to Small Projects with Big Results	135
Chapter 10: Heating and Purifying Water	159
Chapter 11: Diving In to Swimming Pool Projects	177
Chapter 12: Supplementing Your Domestic Water Heater	187
Chapter 13: Breezeway: Directing Wind within Your House.....	203
Chapter 14: Solar Pumps, Wind Power, Hydro Power, and Batteries in Applications	221
Chapter 15: Glass Houses (and Plastic, Too): Greenhouses and Sunrooms	235
<i>Part IV: Exploring Full-Scale Photovoltaic Systems</i>	247
Chapter 16: Taking a Close Look at Photovoltaic Systems	249
Chapter 17: Is a Full-Scale PV System Worth the Investment?	271
Chapter 18: Divorcing the Grid: Going Solo with Solar Power Systems	287
Chapter 19: Do It Yourself or Contract Out?	299
Chapter 20: Finding the Cash to Get the Job Done.....	311

<i>Part V: Buying, Selling, and Building a Solar Home ...</i>	323
Chapter 21: Building a Solar Home from the Ground Up.....	325
Chapter 22: Buying and Selling a Solar Home	337
<i>Part VI: The Part of Tens</i>	349
Chapter 23: Ten Best Solar Investments.....	351
Chapter 24: Ten or So Best Do-It-Yourself Projects.....	357
Chapter 25: Ten Cheap Solar Projects and Devices	363
Chapter 26: Ten or So Worst Solar Mistakes.....	367
<i>Index</i>	371

Table of Contents

<i>Introduction</i>	1
About This Book	1
Conventions Used in This Book	1
Foolish Assumptions	2
How This Book Is Organized	2
Part I: Playing the Energy Game	2
Part II: Understanding Solar — Just the Facts, Ma’am	3
Part III: Applications Aplenty: Projects from Small to Large	3
Part IV: Exploring Full-Scale Photovoltaic Systems	3
Part V: Buying, Selling, and Building Your Solar Home	3
Part VI: The Part of Tens	4
Icons Used in This Book	4
<i>Part 1: Playing the Energy Game</i>	5
Chapter 1: Helping the World through Solar Power	7
Looking for Sustainable Energy	8
Understanding Why Solar Is King	9
Reaping financial rewards	9
Erasing your carbon footprint	11
Enjoying solar’s unlimited supply	13
Exercising your legal rights to sunlight	13
Appreciating solar energy’s versatility	14
Gaining independence from fossil fuel sources	15
Eliminating peak power grid problems	16
Acknowledging the Dents in the Crown	17
Initial costs and falling prices	17
Reliability and timing	17
Red tape and aesthetically minded neighbors	18
Effort and upkeep	19
Unscrupulous contractors and wild claims	20
Small to Supergiant: Choosing Your Level of Commitment	22
Small- to mid-sized projects	22
Large projects	23
Designing a solar home from scratch	23
Chapter 2: Surveying Your Household Energy Efficiency and Use . .	25
Dissecting Your Energy Bills	26
Collecting the data	26
Divvying up costs, month by month	27



- Checking out a sample electric bill..... 29
- Accounting for anomalies 33
- Adding Up Typical Energy Usage 34
- Auditing Your House..... 36
 - Plugging leaks 36
 - Checking insulation 40
 - Minding the details 41
 - Analyzing your major appliances 43
- Getting Professional Audits..... 43

Chapter 3: Making Your Home Energy Efficient 45

- Conserving Energy without Reducing Quality of Life 46
- Changing Habits and Equipment Is Hard to Do — Or Is It?..... 47
 - Lighting 47
 - Appliances and electronics 48
 - Hot water 53
 - Heating, ventilation, and air conditioning 55
 - Structural changes: Windows and roofs 56
 - Swimming pools and hot tubs 58
- Window Covers: Blinds, Awnings, and Shades 59
 - Blinds..... 59
 - Awnings..... 60
 - Shades and screens 61
- Optimizing Operating Schedules 62
 - Controlling heating and cooling..... 62
 - Opening and closing windows and doors..... 64

***Part II: Understanding Solar —
Just the Facts, Ma'am..... 65***

Chapter 4: Working with Solar Basics 67

- Understanding the Nature of Light..... 67
- Here Comes the Sun: Radiation Reacting with Matter 69
 - A bit of light interaction 70
 - Look! Up in the sky! Light
through the atmosphere 71
- Using Sunlight Converted into Heat 73
 - On the move: Modes of heat transfer..... 73
 - Keeping the heat where you want it 74
- Converting Sunlight into Electricity: Photovoltaic Cells 75
- Understanding Photovoltaics in More Detail..... 76
 - The basics of every PV cell..... 76
 - Looking at different module types..... 77

Analyzing module performance 78
 Shining a light on PV arrays 79
 Looking into the Future 80

Chapter 5: Evaluating Your Solar Potential 81

Mother Nature in Your Neck of the Woods: Climate 81
 Plotting Your Sun Charts 86
 Charting out the basic path of the sun 86
 Adding skyline effects 87
 Noting sunlight intensity 88
 Collector Cross Sections 89
 Mounting Your Collectors Optimally 91

Chapter 6: Calculating Payback on Your Solar Investment 93

Analyzing Solar Investments 94
 Calculating net costs 94
 Figuring out monthly savings 96
 Putting the numbers together: Figuring payback 98
 Analyzing risk 99
 Accounting for the intangibles 100
 Examining Real-Life Scenarios 101
 Supplementing an existing water heater with solar 101
 Putting money in a bank or stock market 102
 Accounting for pollution 103
 Reaping rewards of rising energy costs 104
 Calculating for different rate structures 105
 Appreciating a solar home's increase in value 107
 Financing solar investments with a home equity loan 108
 Replacing broken water heaters 108
 Diving in to swimming pool solar heaters 109
 Blowing hot air 109
 Working with solar in your home office 110

Chapter 7: Installing Your Solar System 111

Paying Attention to Your Pocketbook 111
 The Best Projects for Do-It-Yourselfers 112
 Considering the Best Overall Investments 114
 Getting the Most Out of Your Equipment 115
 Playing It Safe 116
 Intertie PV-generating systems 116
 Plumbing and electrical work 116
 Solar panels 117
 Water heaters 117
 Batteries 117

***Part III: Applications Aplenty:
Projects from Small to Large* 119**

Chapter 8: Digging In to Landscape Projects121

Building a Solar Fountain.....	121
Making a basic barrel solar fountain.....	122
Designing your own master creation	127
Lighting Your Yard with Solar	129
Planting Trees and Shrubs for Shade and Wind Control.....	130
Planting for your day in the shade	130
Directing the wind	130
Anti-solar Power: Using Awnings, Lattices, and Overhangs	132

Chapter 9: Jumping In to Small Projects with Big Results.135

Going for Gizmos, Gadgets, and More	135
Washing with portable showers	136
Shining light on solar flashlights.....	136
Doing yard work with solar machinery.....	137
Creating ambience with swimming pool novelty lights	137
Spreading holiday cheer	138
Coverings and Barriers: Letting (Or Not Letting) the Sun Shine In.....	138
Choosing locations for window coverings	138
Investing in blinds and drapes.....	140
Installing sunscreens for summer.....	141
Putting up radiant barriers.....	144
Securing Your Home	145
Hosing down your problems	146
Blasting the bad guys with light.....	146
Engaging in Small Power Projects	147
Battery power: Charging up your life.....	147
Small-scale PV systems: Using just a modest amount of power... 148	
Working with RV appliances	149
Going Off-Grid on a Piece-by-Piece Basis.....	149
Making your reading lamp go off-grid	149
Installing solar light tubes (tubular skylights).....	150
Using tabletop solar fans	152
Cooking with the Sun	153
Making a solar oven.....	153
Cooking with a solar oven	154
Improving your next solar oven design	157

Chapter 10: Heating and Purifying Water159

Exploring Water Heating Systems	159
Getting the Scoop on Solar Components.....	160
Collecting the sunlight	161
Pipe dreams: Setting up the flow of traffic.....	166
Completing the flow system with valves and monitors	168

Forcing the issue with pumps and thermosiphons 170
 Directing traffic with controllers 170
 Addressing mounting concerns 171
 Deciding Whether to Do It Yourself 172
 Weighing your options 172
 Going it alone: A guide to the skills you need
 for different projects 173
 Purifying Your Drinking Water 174

Chapter 11: Diving In to Swimming Pool Projects 177

Warming Your Pool With Solar Pool Covers 177
 Understanding how covers work 178
 Reviewing operational considerations 178
 Getting the most out of your pool cover 179
 Looking at the Pluses and Minuses of a Solar Pool Heater 179
 Making Your Swimming Pool Efficient 180
 Understanding a Simple Starter System 181
 Deciding on the Size of Your Collectors 183
 Installing a Complete System 184
 Creating a Simple Homemade System 185

Chapter 12: Supplementing Your Domestic Water Heater 187

Looking at the Various Systems 187
 Highlighting the most popular systems 188
 Skimming through the lesser systems 189
 Considering factors that dictate the type of system 190
 Following Good Advice (Mine) 192
 Heating Things Up in Your Old Hot Tub 193
 Installing an ICS Batch System for Mild Climates 194
 Installing a Drainback System for Most Climates 196
 Installing an All-Weather, Closed-Loop Antifreeze System 198
 Taking a Quick Peek at Radiant Heat Floor Systems 200

Chapter 13: Breezeway: Directing Wind within Your House 203

Capitalizing on Natural Ventilation 203
 Catering to the prevailing winds 204
 Letting the heat rise: Chimney effect 205
 Optimizing air movement 206
 Dealing with seasonal variations 208
 Choosing and Using Your Fans 209
 Viewing fan efficiency and operation 209
 Considering fan types 211
 Directly Powering Tabletop and Ceiling Fans 215
 Installing a Solar Attic Vent Fan 215
 Opting for solar 216
 Choosing the best location 216
 Selecting the type of fan for your application 218
 Building a Solar Space Heater 219

Chapter 14: Solar Pumps, Wind Power, Hydro Power, and Batteries in Applications 221

Directly Powering Pumps and Motors	222
Water supply systems	222
Swimming pool pump systems	224
Working with PV Systems with Batteries	225
Assessing your power needs	225
Powering remote and mobile locations	228
Wind and Water Solar Power	229
Blowing with the wind	230
Using water resources for your power needs	232

Chapter 15: Glass Houses (and Plastic, Too): Greenhouses and Sunrooms 235

Choosing a Type of Solar Room	236
Growing green things	236
Basking in the sunroom	237
Exploiting Natural Effects	237
Understanding the greenhouse effect	238
Up, up, and away with the chimney effect	238
Taking a Quick Look at Typical Projects	240
Getting the Most Out of Your Design	240
Anatomy of a solar room	241
Following design and building tips	244

Part IV: Exploring Full-Scale Photovoltaic Systems..... 247

Chapter 16: Taking a Close Look at Photovoltaic Systems 249

The Benefits of Powering Your Home with PV Systems	250
Looking at the Basic Components of a Intertie System	252
Various types of panels	253
Mounting equipment	254
DC-to-AC inverters	257
Tracking mounts	262
Disconnect switches	263
Wiring and fuse box connections	263
Utility power meters	264
Installing a PV System	264
All the things you need to do: The process in a nutshell	265
Contractor or DIY? Things to think about	268
Working with kits	269
Safety	270

Chapter 17: Is a Full-Scale PV System Worth the Investment? 271

- Why an Intertie System Makes Financial Sense 271
 - Exploiting every bit of energy your system generates 272
 - Understanding net metering..... 272
- Determining System Size 273
- Predicting System Production 274
 - Panel types 276
 - Inverter type..... 276
 - Tilt angle 276
 - Azimuth..... 276
 - Shade levels..... 277
 - Distance from the roof 277
 - Rated DC and AC output 278
 - Expected energy output..... 278
- Calculating Monthly Savings 279
 - Types of rate structures 279
 - Analyzing monthly savings in detail..... 282
- Calculating the Cost of a System 286

Chapter 18: Divorcing the Grid: Going Solo with Solar Power Systems 287

- Understanding Off-Grid Ramifications 287
 - Considering higher costs and maintenance 288
 - Looking green 289
- Surveying Off-Grid Solar Options 289
 - AC or DC..... 290
- Understanding Batteries (Familiarity Breeds Contempt) 291
 - Battery types 292
 - Capacity and efficiency 292
 - Maintenance 293
 - Lifetime..... 293
 - Risks 293
- Specifying and Pricing Your Systems..... 294
- Peeking In on a Real-Life Scenario 295
 - Calculating needs..... 296
 - Checking out the complete system 297

Chapter 19: Do It Yourself or Contract Out? 299

- Design and Installation Issues That Can Influence Your Decision 299
- Getting Good Information..... 300
- Being Realistic about Codes and Regulations..... 301
 - On the honor system: Choosing to follow code..... 302
 - Passing code..... 303
- Hiring a Contractor..... 304
 - Knowing what a contractor can do 304
 - Getting bids 305
 - Comparing bids 305

Interviewing a contractor	307
Contracting	308
Working with a contractor after the job begins.....	309

Chapter 20: Finding the Cash to Get the Job Done 311

The Different Types of Subsidies.....	311
Rebates.....	312
Tax credits	314
No property tax increases	314
Incentives for home-operated businesses.....	315
Net metering.....	315
Tax-deductible home equity loans	316
Researching All the Subsidy Options.....	316
Getting a Loan For Your Solar PV System	317
Borrowing money the old-fashioned way.....	317
Using an energy-efficient financing program.....	318
Pursuing energy efficient mortgages.....	319
Thinking about other mortgage options.....	319
Considering Alternative Financing	320
Leasing solar equipment.....	320
Buying an energy-producing plot of land	320
Working with Banks (Their Way or the Highway).....	321

Part V: Buying, Selling, and Building a Solar Home..... 323

Chapter 21: Building a Solar Home from the Ground Up 325

Following the Basic Rules of Home Building.....	326
Location, Location, Orientation.....	326
Evaluating local building codes and regulations	327
Considering the solar potential	328
Designing Your Solar Home.....	329
Taking advantage of your lot's features.....	330
Getting the basic principles right	330
Starting on the design from the outside	331
What living space works best where.....	332
The Devil's in the Details of Fabrication.....	333
Floors and windows.....	333
Appliances and utilities.....	333
Roofing and ventilation	334
Time to Start Pounding Nails	335

Chapter 22: Buying and Selling a Solar Home 337

Buying an Existing Home with the Intention of Installing Solar	338
Dwelling on the pros.....	338
Considering the cons.....	339
Getting the information you need.....	340

Buying an Existing Solar Home 341
 Checking out the home 341
 Determining a solar home's value 345
 Selling Your Solar Home for Big Bucks 347

***Part VI: The Part of Tens* 349**

Chapter 23: Ten Best Solar Investments 351

Nurturing Mother Nature with Landscaping..... 351
 Installing PV Systems to Offset the Most Carbon Pollution..... 352
 Using a Solar Swimming Pool Heater 352
 Putting a Cover on Your Swimming Pool..... 353
 Harnessing the Sun to Heat Your Water 353
 Lighting Your Yard All Night Long 354
 Redecorating for Functionality and Appearance..... 354
 Putting Up Overhangs to Make Your Home More Comfortable 355
 Increasing Your Living Space..... 355
 Banishing Hot Air with a Solar Attic Vent Fan 356

Chapter 24: Ten or So Best Do-It-Yourself Projects. 357

Using Just About Every Tool in the Box
 to Install a Solar Water Heater 357
 Literally Going Green with Landscaping 358
 Venting Your Attic and Cooling Off the Entire House..... 358
 Sheltering Living Spaces from the Sun 359
 Warming up the Water with an Off-Grid
 Solar Swimming Pool Heater 359
 Providing an Endless Source of Purified Drinking Water 360
 Now You're Really Cooking 360
 Charging Your Batteries the Solar Way 361
 Reading Under the Sun at Night..... 361
 Pumping Water to New Heights with a Solar Fountain..... 361
 Getting Creative with a Solar-Powered Sprinkler 362

Chapter 25: Ten Cheap Solar Projects and Devices 363

Landscape Lighting 363
 Portable Showers..... 364
 Sunscreens with Roll-up Mechanisms 364
 Solar Fountains 365
 Sun Tea 365
 Battery Chargers..... 365
 Solar Cooking 366
 Solar Hat Fans 366
 Solar Lamps..... 366
 Solar Flashlights..... 366

Chapter 26: Ten or So Worst Solar Mistakes 367

- Installing Like Curly, Moe, and Larry 367
- Opting for a Solar Swimming Pool Heater
 - Rather Than a Solar Cover..... 367
- Going Out of Your Mind by Going Off-Grid..... 368
- Relying on Solar When You Rarely See the Sun..... 368
- Cheaping Out on Water Heater Systems 369
- Your Eyes Are Bigger Than Your Stomach 369
- Skipping the Groundwork..... 369
- Going with the Cheapest Bid Because It’s the Cheapest..... 370
- Ignoring Murphy’s Law 370

***Index*..... 371**

Introduction

Solar *Power Your Home For Dummies*, 2nd Edition, can help you turn your solar inspirations into reality without losing your shirt or your sanity. With this book — and with some good, hard work and perseverance on your part — you can achieve the laudable goal of installing solar power equipment at your home.

About This Book

This book provides you with an ample solar knowledge base and lets you apply that info through do-it-yourself projects — or through hiring others to do the work for you. I use plain English to the extent possible, breaking down complex technical concepts into bite-sized pieces. But my goal is always to help you navigate the maze of solar technology as efficiently and sensibly as possible.

Every house is different. Climates are different, even in areas separated by a couple of miles. Markets are evolving, suppliers are changing, and technology is constantly evolving. Sometimes you're going to have to make your own decisions, and I can give you only the pertinent information you need to make the best one. Or in some cases, all I can do is point you toward the information sources you need to consult. But you can find the essentials here, tailor them to your own situation, and get a solar system that really works for you.

Conventions Used in This Book

For simplicity's sake, this book follows a few conventions:

- ✓ *Italicized* terms are immediately followed by definitions.
- ✓ **Bold** indicates the action parts in numbered steps. It also emphasizes the keywords in a bulleted list.
- ✓ Web addresses show up in `monofont`.
- ✓ When this book was printed, some Web addresses may have needed to break across two lines of text. Rest assured that I haven't put in any extra characters (such as hyphens) to indicate the break. Just type in exactly what you see in this book, pretending as though the line break didn't exist.

Foolish Assumptions

Here are some things I assume about you:

- ✔ **You want to add a solar component to your home.** I assume that you've already decided to move but aren't really sure which is the best direction or the best speed. You want to make the right decisions, and you understand those decisions are entirely yours to make.
- ✔ **You have some do-it-yourself skills.** You — or whoever's helping you install the equipment — can handle a screwdriver and power drill. You may know the basics of plumbing or electrical work.
- ✔ **You want to get things done as efficiently and sensibly as possible.** (Note I didn't say *quickly*, because that leads to errors in both judgment and facilitation.) You don't necessarily have an engineering degree, and you don't want to know every technical detail concerning the various solar technologies.
- ✔ **You need working knowledge of a project so that you can hire professionals and discuss matters with them.** You don't plan on handling a major project yourself, but you want enough information to make informed decisions.
- ✔ **You've got the right attitude for tackling projects.** Projects rarely, if ever, go the way you envision when you were drawing up the plans. As a lifelong practitioner of projects big and small, I've learned to be patient and enjoy the road every bit as much as the destination. When you run into problems — which you will — smile and take a step back and come up with a witty joke. The harder a project is, the more rewarding it'll be when it's finished. I can pretty much guarantee that you're going to find out precisely what I'm talking about.

How This Book Is Organized

This book has seven parts. Without further ado, here are the parts of the book and what they contain.

Part 1: Playing the Energy Game

In this part, you find info on doing a home energy audit so that you can understand exactly how and where you use energy in your home. I also give you a guide to making improvements in your house so your energy consumption's more efficient.

Part II: Understanding Solar — Just the Facts, Ma'am

For most users, this part may be the most difficult to read because the technical and financial concepts can be elusive. Hang in there — understanding the nuts and bolts can make it easier to make the right decisions later on. After you get through the preliminaries, I help you decide which direction is best for you, and then you're on your way.

Part III: Applications Aplenty: Projects from Small to Large

This part dives into solar power projects that you can start with right now. I describe a lot of interesting and useful little gadgets and small systems that can make your life easier and more fun. Regardless of how ambitious your solar aspirations may be, this is a good place to start. Greenhouses and solar rooms have some fundamentals that are consistent with all projects that you need to understand, so I cover the basics of what you need to know.

Part IV: Exploring Full-Scale Photovoltaic Systems

Part IV gets into photovoltaic (PV) projects. I describe the different types of equipment that are on the market, and how best to choose the right equipment for your particular application. I give advice on deciding whether to do a project yourself or to hire a contractor, and I give advice on how to hire someone. I also detail how to specify a large-scale PV system and how to find and hire a contractor to do the installation for you. Financing is important because PV costs a lot; I give some useful advice on how to work with subsidies and rebates, and also banks and lending institutions. For those who want to go off-grid, I tell how best to do it and under what circumstances it's merited.

Part V: Buying, Selling, and Building a Solar Home

In Part V, I give a broad range of advice on how to value a solar home, whether you're on the buying or selling end. And I tell you how best to find a bare lot and develop your dream of building your own solar home.

Part VI: The Part of Tens

Like every *For Dummies* book, the Part of Tens includes quick resources that provide plenty of information and sage advice compacted into few words. Above all, this part demonstrates that you aren't alone. Gain wisdom from other solar energy enthusiasts' trials and errors.

Icons Used in This Book

The icons in this book can quickly steer you to the information you need. Here's what they stand for:



The Tip indicates a paragraph that elaborates on a nifty little shortcut or frustration-saver.



This icon highlights important information to store in your brain for quick recall at a later time.



This icon should never be ignored. It points out things that can potentially harm you or your project. Remember: A successful project relies on many factors, both economic and practical, but the most important gauge of a successful project is that nobody gets hurt!



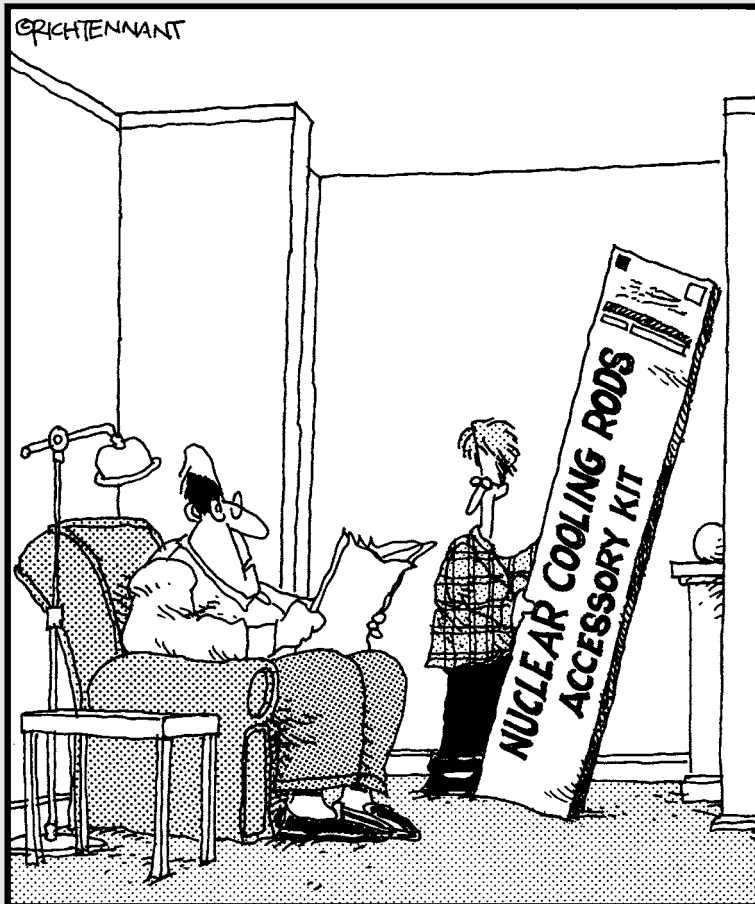
The Technical Stuff icon lets you know that some particularly nerdy, technoid information is coming up so you can skip it if you want. (On the other hand, if you want to read it, you don't actually have to be a nerd — just able to read.)

Part I

Playing the Energy Game

The 5th Wave

By Rich Tennant



"Hold off on that. I think we're going to get solar panels."

Y ***In this part . . .***

ou may be ready to go solar, but first you need to take a look at how you use energy in your household and how your energy bill is measured and calculated. Solar investments can save you money and make your life more comfortable, but part of the process is understanding exactly what types of solar investments you should make — and how big they should be. Here, I show you how to systematically dissect your energy bills and how to look around your house to find all kinds of energy conservation measures to reduce your energy bill even before you invest in solar.

Chapter 1

Helping the World through Solar Power

In This Chapter

- ▶ Investing in solar energy
 - ▶ Looking at the benefits of solar power
 - ▶ Solving for challenges
-

Producing energy can be dirty work. Carbon emissions, coal slurry, nuclear waste, and other pollutants can wreak havoc on the environment, cause health problems, and make people hopping mad. And many energy sources are in limited supply, particularly fossil fuel sources that have traditionally dominated the world's energy usage. Not only does that drive prices up, but it also leads to political conflicts when people decide they're not willing to share. You're probably not ready to go completely unplugged, but you do want to play your humble part to save the environment, help the country become less dependent on foreign energy sources, and save money. Tall order? Maybe not. Above all the energy sources in use today, solar shows the most long-term promise for solving the world's energy problems. Solar power works well on both large and small scales, and it is possible to start using solar power right away. You can start small, and work your way up.

On any given day, 35,000 times the total amount of energy that humans use falls onto the face of the Earth from the sun. If people could just tap into a tiny fraction of what the sun is providing each day, society would be set. Of course, some problems do crop up, but they're solvable, and going solar can be well worth the effort.

To understand the role solar energy can play in your home, you need to have a good understanding of where your own energy comes from, where it's used, and how much pollution each of your energy sources generates. In this chapter, I explain how solar fits into your day-to-day life — and why it's such a good energy option.

Looking for Sustainable Energy

The words *renewable* and *sustainable* are being knocked around quite a bit, and both are strongly associated with energy conservation. *Renewable* forms of energy constantly replenish themselves with little or no human effort. Solar energy is just one example — no matter how much you use, the supply will never end (okay, it may end after billions of years, but your using solar power won't make the sun burn out any faster). Other examples of renewables include firewood, water (through hydroelectric dams), and wind power. Note, however, that firewood is notoriously polluting; the term *renewable* does not necessarily imply good environmentalism. Firewood also has another potentially severe drawback in that people go out into forests and cut down trees, often without much thought to the overall health of the forest (a good example of not seeing the forest from the trees).

To make sure that resources last, humans need to focus on conservation, recycling, environmental restoration, and renewable and alternative energy sources. *Sustainability* is commonly associated with such a holistic approach to personal lifestyle. Not only are *sustainable* forms of energy renewable, but they also have the ability to keep the planet Earth's ecosystem up and running, in perpetuity. Sustainable energy, such as solar, is nonpolluting to the greatest extent possible. The basic notion behind sustainable energy sources is that by their use, society is not compromising future generations' health and well-being, nor their ability to use their own sustainable resources to any less capacity than we have in the past. Who can argue with this very fundamental version of the Golden Rule?



Consuming the Earth

Here are some statistics about power use in the United States (from DOE):

- ✓ Americans import more than half their fossil fuels. Thirty years ago, this figure was only 33 percent, and analysts predict that within a few years, it'll rise to 66 percent. Even though new energy reserves are being found, our increasing consumption of energy is more than offsetting our increased domestic production.
- ✓ Of all the energy used in the United States, 39 percent comes from oil, 23 percent from natural gas, 24 percent from coal, 6 percent from hydropower dams, 7 percent from nuclear, and only 1 percent from renewables such as solar energy. On the plus side, the use of renewables is increasing much faster than other forms of energy, particularly with all the government subsidies and incentives that are being promoted.
- ✓ Americans get 51 percent of their electrical production from coal, 20 percent from nuclear, 18 percent from natural gas, 2 percent from petroleum, and only around 9 percent from renewables, of which the vast majority is hydro (water). Solar plus wind accounts for only around 0.18 percent of the grand total.

Understanding Why Solar Is King

Solar power has historically been more expensive than other energy options, but that's changing fast because of government investment in technologies, as well as the simple fact that many more people are investing in solar, which results in economies of scale. Solar energy equipment increases your financial standing in basically three ways:

- ✓ Savings on your monthly utility bills.
- ✓ Appreciation of your home's value.
- ✓ Predictability in your utility bills for years to come. When utility rates increase, you'll be largely immune from the increases because you'll be getting your energy from a local source that's not tied in to the utility. Of all these three factors, this one seems to drive people to invest in solar the most.

The following sections cover reasons why solar is a great investment, both financially and environmentally.

Reaping financial rewards

Solar is an investment; you must actively go out and purchase solar equipment and install it at your home. However, after the initial costs, not only do you save money from lowering your energy bill, but you will also see the value of your home increase.

Comparing savings

So how does investing in solar compare to other investments, such as the stock market, a savings account, or a new kitchen?



To compare investments, you need to calculate your payback period. *Payback period* is a measure of how long it takes to recoup your upfront investment with the costs you save by installing solar equipment. If you install a solar water heater system for \$4,000 and it saves you \$50 a month on your power bill, the system will pay for itself in 80 months, or 623 years. (Though you may easily cut that time in half if the price of oil skyrockets and utility rates double, for example, during a war in the Middle East.)

Now consider other ways you can spend that money. With investments in remodeling, such as a new kitchen, you get no monthly cost reductions at all unless you're installing new appliances that are more energy-efficient. Historical data indicates that if you remodel your home with a new kitchen, you'll only recoup around 70 percent of the cost of the remodel when you sell your home. If you put the same \$4,000 into an interest-bearing bank account,

you may get \$20 a month in interest (that's at an interest rate of 6 percent, which is difficult to find these days). After 80 months, you'd make \$2,000 in compounded interest, or half your investment. And if you put the same money into the stock market, you may enjoy a return of \$3,400 in a single year. Of course, you can also lose the entire thing and drive yourself nuts with regret!

When you install a solar PV system, historical data indicates that you will recoup nearly 100 percent of your investment. If you spend \$25,000 on a PV system, your home's value will increase by around \$25,000, maybe even more if utility rates increase precipitously. It may be said that no other investment that you can make in your home will recoup as much.



To play it safe, choose a variety of investments and decide how much you want to put toward solar power. Stock portfolio managers consider hedging an important facet of a good portfolio. *Hedging* basically entails spreading the risk around over a range of individual investments. That way, if one of your investments goes sour, the effect on your entire investment portfolio will be minimal. "Don't put all your eggs in one basket," as the saying goes.

In short, if you install solar, you'll be relatively risk free from exploding energy costs. If you install a solar PV system that produces as much electricity as you use in your home, you'll never have to worry about paying another electric bill. And you won't have to worry about utility rate increases.

Showing a little appreciation

When you go solar, your home *appreciates*, or increases in value. Realtors can give you statistics that estimate how much the value will go up, given the type of investment and the area you live in.

According to the National Association of Real Estate Appraisers (NAREA), for every dollar you save annually in energy costs with solar equipment, the value of your home increases by up to 20 times your annual energy savings, depending on the type of system you install. For a solar water heater investment of \$4,000, the value of your home may increase by at least that much! How can this be? Solar is catching on, and homebuyers are willing to pay more for solar homes that promise energy savings. People are more and more willing to invest in energy systems that are clean and reliable, compared to the fossil fuel mainstay. In some communities, a solar home will sell much faster than a conventional home, and this may be important if you need to move quickly.

Taking advantage of subsidies

Right now, a wide range of government and industry programs are available to help you finance your solar investments. Governments are giving out tax breaks, utilities are offering rebates, and low-interest loans are available for solar investments. The net effect is to make your solar projects less expensive and more attractive on the bottom line. With any solar investment, it's