

Power With Nature

– UPDATED 2ND EDITION –

Alternative Energy Solutions
for Homeowners

Rex A. Ewing



PIXYJACK PRESS LLC

Table of Contents

PROLOGUE	ix
2ND EDITION PREFACE	xiii
<i>Dog of the Sun. Cat of the Wind.</i> A Primer Disguised As A Fable	15
<i>Beyond the Grid</i>	
1 A NEW PHILOSOPHY OF FREEDOM <i>Learning To Think Beyond The Grid</i>	78
2 GRID-TIED OR OFF-GRID? <i>Should you jump in head first, or just get your feet wet?</i> Grid-Tie Systems, With & Without Batteries Comparison of Systems	85
3 BEGINNING CONSIDERATIONS <i>Building Smart To Keep The Power Bill Low</i> Passive Solar Design for Efficiency & Comfort Non-Living Spaces Solar and Wind Considerations Backup Generators Evaluating Your Electrical Demands	97
4 SIZING THE SYSTEM <i>A Short, No-Tooth-Pulling Course On Practical Electricity</i> Beyond Ohm's Law 12, 24, 48 Volts, Or More? How Much Generating Capacity? How Many Batteries?	111
5 SOLAR PHOTOVOLTAIC MODULES <i>How To Capture A Ray Of Sunshine</i> Types of Solar Modules Finding a Place for the Array Where Is North? Tilt Angle of the Array Mounting the Modules Wiring the Array Leaving Room to Grow How Do Solar Cells Really Work?	117
6 WIND TURBINES <i>Making Good Use Of The Stuff Of Clouds</i> How Much Wind is Enough? Wind Turbine Basics Will Wind Power Work For You? Turbines Towers Turbine Comparison Chart	139

continued

7	MICRO-HYDRO POWER	157
	<i>Developing A Meaningful Relationship With Gravity</i>	
	Sizing-Up the Possibilities Components Getting Down to Particulars	
8	CHARGE CONTROLLERS	169
	<i>Processing Your Batteries' Diet</i>	
	Battery Charging Equalization of Batteries A Charge Controller for the Wind Turbine MPPT Other Uses for Charge Controllers Sizing for the Future	
9	BATTERIES	181
	<i>Care And Feeding Of The Beasts That Hold Your Sunshine</i>	
	The Right Batteries for the Job Pampering Your Batteries The Battery Box and Keeping Your Batteries Warm Wiring the Batteries Homegrown Hydrogen	
10	INVERTERS	197
	<i>The Last Stop On The DC Trail</i>	
	Off-Grid & Grid-Tie Inverters Inverter Functions	
11	PUTTING IT ALL TOGETHER – SAFELY	209
	<i>Protecting You And Your System From Each Other, And Nature</i>	
	Grounding & Bonding Lightning Protection Solar Array, Wind Turbine & Micro-Hydro Safety Charge Controllers DC Disconnect Wiring It Safely	
12	HEATING OF HOUSE AND WATER	220
	<i>Staying Warm Without Busting The Energy Bank</i>	
	Propane Wall Heaters Forced Air Heat Geothermal Heating with Hot Water & Solar Hot Water Wood & Masonry Stoves Wood-Fired Boilers Corn & Pellet Stoves Heating Domestic Hot Water	
13	PUMPING WATER	241
	<i>Getting It From The Ground To Your House, Without Overtaxing the System</i>	
	Should You Install A Cistern? Rainwater Collection Well Pumps: AC & DC	
14	FINAL THOUGHTS	250
	<i>Learning To Trust Mother Nature</i>	
	Changing With The Weather—A Metaphor	

continued

PERSONAL POWER COMPANIES

Homeowner Profiles	110, 138, 156, 180, 196, 208, 249
ACKNOWLEDGMENTS	254
APPENDICES	
Appendix A:	
Checklist of Equipment	255
Illustration: Components of Renewable Energy	256
Power Consumption of Appliances	258
Notes on Appliances	259
Energy Conversion Formulas	259
Appendix B:	
SYSTEM SIZING	
Shopping for a PV System	260
Steps to Sizing Your System	260
Our System/Home/Power Consumption	261
U.S. Wind Map	262
Your Electrical Needs Worksheet	263
Insolation Maps (Solar Radiation)	264
Solar Array Sizing Worksheet	265
Battery Sizing Worksheet	266
Appendix C:	
Micro-Hydro Formulas & Conversion Factors	267
Appendix D:	
Electrical Formulas & Helpful Information	268
Wire Size/Line Loss Tables	
12-volt	270
24-volt	271
48-volt	272
Appendix E:	
RESOURCES	273
GENERAL BIBLIOGRAPHY	275
GLOSSARY	276
INDEX	282
LIST OF ILLUSTRATIONS	286
ABOUT THE AUTHOR	287