

# Contents

<b>Preface</b> . . . . .	xiii
<b>1. Introduction to Small-scale Wind Energy</b> . . . . .	1
World Wind Energy Resources . . . . .	8
The Pros and Cons of Wind Energy . . . . .	10
The Purpose of This Book . . . . .	24
Organization of This Book . . . . .	26
<b>2. Understanding Wind and Wind Energy</b> . . . . .	29
What Is Wind? . . . . .	30
Offshore and Onshore Winds . . . . .	30
Mountain-Valley Breezes . . . . .	32
Large-scale Wind Currents . . . . .	34
Wind from Storms . . . . .	38
Friction, Turbulence, and Smart Siting . . . . .	40
The Mathematics of Wind Power . . . . .	44
Closing Thoughts . . . . .	48
<b>3. Wind Energy Systems</b> . . . . .	49
Components of a Wind Energy System . . . . .	49
Wind Energy System Options . . . . .	54
Hybrid Systems . . . . .	76
Choosing a Wind Energy System . . . . .	78
<b>4. Wind Site Assessment</b> . . . . .	79
Assessing Electrical Demand . . . . .	80
Conservation and Efficiency First! . . . . .	88
Assessing Your Wind Resource . . . . .	91
How Much Electricity Will a Wind Turbine Produce? . . . . .	102

Does a Wind System Make Economic Sense? . . . . .	103
Putting It All Together . . . . .	113
<b>5. A Primer on Wind Generators . . . . .</b>	<b>115</b>
The Anatomy of a Wind Turbine . . . . .	115
Improvements in Small Wind Turbines . . . . .	123
The Main Components of Wind Turbines . . . . .	124
What to Look for When Buying a Wind Turbine . . . . .	127
Other Considerations . . . . .	141
Building Your Own Wind Turbine . . . . .	146
Conclusion . . . . .	149
<b>6. Towers and Tower Installation . . . . .</b>	<b>151</b>
Tower Options . . . . .	154
Homebrew Towers . . . . .	169
Tower Kits . . . . .	169
Tower Anchors and Bases . . . . .	171
Safety First . . . . .	176
Siting a Tower . . . . .	177
Aircraft Safety and the FAA . . . . .	183
Protecting Against Lightning . . . . .	184
Conclusion . . . . .	186
<b>7. Understanding Inverters . . . . .</b>	<b>187</b>
Do You Need an Inverter? . . . . .	187
How Does an Inverter Create AC Electricity? . . . . .	188
Transformerless Inverters . . . . .	194
Types of Inverters . . . . .	196
Buying an Inverter . . . . .	205
Conclusion . . . . .	215
<b>8. Batteries, Charge Controllers, and Backup Generators . . . . .</b>	<b>217</b>
Understanding Lead-Acid Batteries . . . . .	218
Sealed Batteries . . . . .	224
Wiring a Battery Bank . . . . .	226
Lithium Ion Batteries . . . . .	228
Sizing a Battery Bank . . . . .	230
Battery Maintenance and Safety . . . . .	233
Managing Charge to Ensure Longer Battery Life . . . . .	238

Charge Controllers . . . . .	254
Generators . . . . .	260
Living with Batteries and Generators . . . . .	264
<b>9. Maintaining a Wind-Electric System . . . . .</b>	<b>267</b>
What’s Required . . . . .	268
Conclusion . . . . .	275
<b>10. Final Considerations: Zoning, Permits, Covenants, Utility Companies,     Insurance, and Buying a System . . . . .</b>	<b>277</b>
Zoning, Building Permits, and Restrictive Covenants . . . . .	277
Connecting to the Grid: Working with Your Local Utility . . . . .	287
Insurance Requirements . . . . .	290
Buying a Wind Energy System . . . . .	293
Parting Thoughts . . . . .	294
<b>Appendix: Net Metering Policies by State . . . . .</b>	<b>297</b>
<b>Resource Guide . . . . .</b>	<b>301</b>
<b>Notes . . . . .</b>	<b>309</b>
<b>Index . . . . .</b>	<b>311</b>
<b>About the Author . . . . .</b>	<b>319</b>
<b>About the Publisher . . . . .</b>	<b>320</b>