

CONTENTS



Acknowledgments	xi
Introduction	xiii
Chapter 1 History	1
Chapter 2 Conservation and the Economics of Solar Water Heating	7
The True Cost of Fossil Fuel	9
A Brief History of Fossil Fuels	11
Life Cycle Costing	13
Chapter 3 Types of Solar Collectors	21
ICS Collectors	21
Flat Plate Collectors	23
Evacuated Tube Collectors	26
Comparing Flat Plate and Evacuated Plate Collectors ..	27

	Concentrating Collectors	31
	Pool Collectors	31
	Air Collectors	33
Chapter 4	Other System Components	35
	Storage tanks	35
	Heat Exchangers	39
	Pumps	41
	Piping and Pipe Insulation	42
	Solar Fluids	44
	Other System Components	46
Chapter 5	Solar Water Heating Systems	59
	Introduction	59
	Integral Collector Storage Systems	62
	Thermosiphon Systems	64
	Open-Loop Systems	67
	Draindown Systems	69
	Drainback Systems	70
	Closed-Loop Antifreeze Systems	76
	Refrigerant Solar Water Heaters	86
	Solar Heated Pools	87
	Solar Heated Hot Tubs and Spas	91
Chapter 6	Solar Space Heating Systems	95
	Liquid-Type Solar Heating Systems	97
	Liquid-Type Systems with Storage	99
	Heat Storage Configurations	102
	Heat Delivery Methods	106
	High-Mass Systems	113
	Air-Type Solar Heating Systems	118

Chapter 7	Choosing the Right System for Your Needs	123
	Siting a Solar Energy System	124
	Sizing a Solar Water Heating System	133
	Sizing a Solar Space Heating System	139
	Sizing Pumps	147
Chapter 8	System Installation	151
	Installing Solar Water Heating Systems	151
	Handling Solar Collectors	154
	Mounting Solar Collectors	158
	Ground Rack Mounting	172
	Mounting the Heat Exchanger	176
	Plumbing the System	179
	Testing the System	189
	Installing Solar Pool Heating Systems	190
	Installing Radiant Floor Tubing	191
Chapter 9	System Operation and Maintenance	203
	Charging a Closed-Loop System	203
	Controls and Power Sources	209
	Maintenance	216
Appendix A:	Wire Sizing Chart	223
Appendix B:	Metric Conversions	225
Glossary		227
Index		233
About the Authors		239