

Contents

Preface xiii

Contributors xv

Acknowledgments xix

CHAPTER 1	The Integrated Building Design Process.....	1
	What Is Integrated Building Design?	1
	The Process.....	1
	The Focus Areas: Energy, Resources, and Indoor Environment.....	6
CHAPTER 2	A History of the Environmental Movements.....	15
	Roots	15
	Grassroots Movements	17
	The Industrial Revolution	19
	The Modern Chemical Revolution.....	20
	Twin Tracks of Environmentalism: Conservation and Preservation Movements.....	21
	The Ecology Movement.....	24
CHAPTER 3	International Conferences and Treaties	27
	The Club of Rome.....	30
	The International Conferences.....	31
	After Kyoto	35
CHAPTER 4	The Emergence of Green Building and Green Building Policy	39
	Defining Green Building	40

The Roots of Green Building	42
Environmental Toll.....	43
Green Building Today.....	44
The History of U.S. Energy Policy	46
Green Building Codes in the United States.....	49
The Road to Green Codes.....	51
In Summary	53
CHAPTER 5 Chemicals in the Environment, Buildings, and Humans	55
Emission, Transmission, Deposition, and Immission.....	55
Pathways of Transmission.....	61
The Right to Know: Chemical Transparency.....	63
Green Chemistry and Building Materials	72
Rethinking Building Systems.....	73
Air Systems	74
CHAPTER 6 Fundamentals of Indoor Air Quality.....	79
<i>Leon Alevantis, MS, PE, LEED AP</i>	
Why Is Good IAQ Important?.....	79
Contributors to IAQ	80
Types of Indoor Pollutants.....	81
Pushing the Envelope for IAQ Design.....	84
CHAPTER 7 Indoor Environmental Quality Issues.....	93
What Is IEQ?.....	93
Other IEQ Issues	103
Benefits of Good IEQ	104
CHAPTER 8 How Buildings Use Energy	107
Energy in the Life Cycle of a Building.....	107
Evolution of Buildings and Its Impact on Energy Consumption	107
Operating Energy Use Patterns.....	110
Heat and Heat Transfer Modes.....	111
Climate and Weather	114
Traditional Design Response to Climate.....	118
Occupant Needs	118
Conclusion	123
CHAPTER 9 Reducing Energy Loads	125
Predesign: Site Selection, Building Size, and Transportation.....	126
Site Analysis	126
Massing and Orientation	128
Building Envelope	128

Lighting.....	138
Plug Loads.....	141
Passive Design.....	142
Case Study: School in Damascus, Syria	149
CHAPTER 10 Energy-Efficient HVAC Systems	155
Central versus Decentralized Systems	156
Decentralized Systems	156
Central Heating and Cooling Systems	159
HVAC Controls.....	165
Domestic Hot Water	167
Thermal Zoning and Impact of Architectural Design	167
Preliminary Design Guidelines.....	168
CHAPTER 11 Energy Modeling and Measurement	171
Metrics for Energy.....	171
Site Energy and Source Energy.....	172
Metering, Submetering, and Benchmarking	173
Energy Modeling.....	176
Energy Modeling Tools	180
Using Modeling to Drive Integrated Cost Estimation.....	183
CHAPTER 12 Net Zero Energy and Renewable Energy Systems	187
NZE Definitions.....	187
On-site Renewable Energy Generation.....	188
NZE Technical Potential.....	193
NZEB Design Issues.....	194
NZE at Community Scale	196
Utility Grid and Distributed Generation.....	196
NZE in Policy	198
Case Studies.....	199
CHAPTER 13 Climate Change and Resilience	207
The Science.....	208
CHAPTER 14 How Buildings Use Resources.....	223
What Are Natural Resources?.....	223
CHAPTER 15 Materials Selection and Product Certification.....	239
The Benefits of Healthy Skepticism	239
Materials Have Multiple Impacts.....	240
The Bases for Materials Selection.....	240
Making Contact with Technical Staff.....	244
Environmental Product Declarations	244

Emissions Testing.....	245
Product Certification, Rating, or Label.....	246
Tools: Putting It Together.....	250

CHAPTER 16 **How Built Landscapes and Buildings Contribute to Water Quality and Conservation** 259

Jamie Phillips and Kevin Conger, CMG Landscape Architecture

The Urban Watershed: Watershed Function	259
National Water Policy	260
Pollutants of Concern in the Landscape.....	261
Urban Stormwater Management: Low-Impact Design	263
Site Design: Primary Goals	263
Preservation and Protection of Creeks, Wetlands, and Existing Vegetation	263
Treatment Control BMPs.....	264
Water Conservation in the Landscape.....	269
Water Use and Energy Use in Buildings.....	270

CHAPTER 17 **Sustainable Neighborhoods and Communities**..... 275

Aaron Welch, Saneta deVuono-Powell, and Matt Raimi, Raimi + Associates

What Are Sustainable Communities?	275
A Brief History of Sustainable Planning.....	276
History of Conventional Development	276
Components of Sustainable City Planning	287
Conclusion	301

CHAPTER 18 **Rating Systems and Practice Tools** 303

What Is a Rating or Certification System?.....	303
Living Building Challenge Mission	309
The WELL Building Standard by Delos	310
Regional Systems.....	312
Ed Mazria and the 2030 Challenge	315
Practice Tools that Drive the Rating System	316

CHAPTER 19 **Life-Cycle Assessment** 321

Definitions	322
Standards and Methodology.....	323
Components	324

CHAPTER 20 **Waste Management and the Building Industry** 337

Waste Impacts	338
Waste Cycles	339
Defining Waste	340
Waste Streams	340

Hospital Waste	341
Integrated Waste Management	342
Benefits of Construction Waste Management	343
Green Demolition	344
Incineration	346
Waste to Fuel	346
Best Practices	348
Diversion	348
Design for Disassembly	350
Construction Waste Management Plans.....	350
Other Job-Site Waste Strategies.....	353
Zero Waste	353

Glossary 357**Index 363**