

Preface

Green building is a relatively new field. Its goal is to substantially reduce the environmental impact of buildings, while providing a healthy environment within buildings. This book seeks to introduce the field of green building, explore a variety of fundamental concepts in green design and construction, and provide guidance to professionals engaged in the field.

This second edition of *Green Building Illustrated* includes expanded discussion and exemplary case studies of zero energy and zero carbon buildings, as well as increased coverage of international building design and construction. There is also added guidance for the schematic design of high-performance buildings and additional material in the area of construction costs and affordability. Specific attention is directed to approaches that simultaneously lower construction costs and reduce greenhouse gas emissions, such as the strategic design of building shape, right-lighting, and more. This second edition also includes a new section on biomimicry and biophilic design; updates to codes and standards; and more information on building electrification through technologies such as heat pumps. Finally, there is increased discussion of place as it relates to green design, and an expanded discussion of climate-specific green design for different regions.

Despite these changes, designing and constructing buildings remains about making choices. It is the creation of choices at the beginning of a project, the evaluation of choices during the design process, the making of choices with the owner, the documentation of choices on drawings, and the implementation of choices through construction. In this book, we have attempted to provide a variety of choices for the design and construction of green buildings.

The book begins by exploring the goals of green buildings and by defining green buildings. It is strongly contextualized within the goal of reducing building-related carbon emissions to counter the increasing impacts of climate change. Various codes, standards, and guidelines are introduced, each of which sets forth requirements to give green buildings further definition.

A methodical exploration of green design is structured by working “from the outside in,” from the community and site, through various layers of the building envelope, and proceeding to examination of the green aspects of lighting, heating, and cooling. Related topics are explored, including water conservation, safeguarding indoor environmental quality, material conservation, and renewable energy.

For energy-related discussions, a variety of first principles of physics are invoked, the combination of which is increasingly referred to as “building science.” For example, first principles of heat transfer are applied to heat loss, and to reducing such loss. We explore aspects of illumination, relating to lighting energy use, and the human interaction and ergonomics of lighting. First principles of fluid dynamics lie behind a discussion of such building-related phenomena as “stack effect” buoyant airflow through buildings. First principles of thermodynamics are applied to the efficient generation and delivery of heat, the transport of heat away from buildings for cooling, and how to increase associated efficiencies in order to reduce energy use.

Detailed illustrations translate these principles and discussions into specific guidance for green building design and construction. A variety of best practices are offered, which are intended to be flexible enough for practitioners to design and construct the green building of the owner's dreams. The illustrations are also intended to be expansive, to offer a wide array of choices possible for green buildings.

Finally, a discussion of the practice of quality is used to explore how design and construction may most effectively deliver the goals sought for green design and construction.

The reader is advised to treat the methods covered in the book as tools. A building does not need to incorporate all the approaches suggested in this book in order to be green. The book is also a broad brush. It would be difficult to cover all the many emerging green building improvements, methods, and products. The focus is instead on underlying tools and strategies, from which professionals can create the choices necessary to design and construct high-performing green buildings.

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—Ian M. Shapiro

Metric Equivalents

The International System of Units is an internationally accepted system of coherent physical units, using the meter, kilogram, second, ampere, Kelvin, and candela as the base units of length, mass, time, electric current, temperature, and luminous intensity. To acquaint the reader with the International System of Units, metric equivalents are provided throughout this book according to the following conventions:

- All whole numbers in parentheses indicate millimeters unless otherwise noted.
- Dimensions 3 inches and greater are rounded to the nearest multiple of 5 millimeters.
- Nominal dimensions are directly converted; for example, a nominal 2×4 is converted to 51×100 even though its actual $1\frac{1}{2} \times 3\frac{1}{2}$ dimensions would be converted to 38×90 .
- Note that $3487 \text{ mm} = 3.487 \text{ m}$.
- In all other cases, the metric unit of measurement is specified.